JUL 17 1925

July 2, 1925

Engineering News-Record

Devoted to Civil Engineering and Contracting
McGraw-Hill Company, Inc.

Everyday Details of Earth Road Maintenance

Points in the Design and Construction of Sewer Pipe

Frost Destroys a Multiple Arch Dam

Two Unusual Bridges for Bronx Parkway, New York

Progress in the Study of the Education of Engineers

American Society for Testing Materials
Report of the Annual Meeting

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ENGINEERING NEWS-RECORD

McGraw-Hill Company, Inc.
JAMES H. McGRAW, *President*
E. J. MEHREN, *Vice-President*

DEVOTED TO CIVIL ENGINEERING AND CONTRACTING

FRANK C. WIGHT
Editor

Volume 95 | NEW YORK, JULY 2, 1925 | Number 1

Engineering News-Record is a consolidation of *Engineering News* and *Engineering Record*, effected in 1917.

Engineering News was founded in 1874 by George H. Frost, as the *Engineer and Surveyor*, which title subsequently became the *Engineer, Architect and Surveyor*, then *Engineering News and American Railway Journal* and finally, *Engineering News*, under the successive editorships of D. McN. Stauffer, Arthur M. Wellington and Charles Whiting Baker.

Engineering Record was established in 1877 by Henry C. Meyer as the *Plumber and Sanitary Engineer*. The name was subsequently changed to the *Sanitary Engineer, Engineering and Building Record* and, finally, to *Engineering Record*. During his ownership of the paper, Mr. Meyer was directly responsible for the editorial policy. John M. Goodell became editor in 1902, and was succeeded by E. J. Mehren in 1912.

The Contractor was consolidated with *Engineering News-Record* in 1918.

E. J. Mehren became editor of *Engineering News-Record* at the time of the consolidation in 1917, and was succeeded by Frank C. Wight, Jan. 1, 1924.

The staff of *Engineering News-Record* consists of *New York:* Frank C. Wight, *Editor;* M. N. Baker, F. E. Schmitt, C. S. Hill, J. W. Shaver and V. T. Boughton.
Chicago: W. W. DeBerard, E. E. R. Tratman.
San Francisco: N. A. Bowers.

An Unseasonable Sermon

THIS may seem a queer time of the year to warn contractors about the dangers of freezing in concrete, but experience shows that it is one of those things that bear constant repetition. Nothing is so well established as the fact that low temperatures, below 50 deg. F., say, retard concrete set and that freezing during the setting period permanently affects its structural stability and surface finish. Nothing has been more frequently hammered home in the literature of engineering. And yet there are still thousands of practical concrete men who have either never heard of this warning or else hold their own knowledge and experience superior to the common knowledge of the industry. We refer to this again these July days because as it is written there is being spent in one of our large cities upward of $70,000 to replace over half of the concrete columns in a new school building, because the contractor, wise in his own conceit, persisted last winter in putting in these columns in freezing weather without the precautions that are well known to be necessary. As happens so often this particular contractor has learned his lesson out of his own pocket, but he could have learned it less expensively by taking oft-proffered advice. As long as such things happen, so long will it be worth while to keep hammering away always in the printed word to watch and protect your concrete in cold weather.

Another Danger from Cold

THE difficulties with the Gem Lake dam, reported on p. 22 of this issue, illustrate another kind of trouble in concrete from freezing. Here was not a disregard of the dangers of low temperature during the placing and setting period, but a gradual breakdown of an apparently satisfactory concrete surface due to unexpected formation of ice on the underwater face of the dam. The concrete of the structure is satisfactory judging by ordinary criteria, for that portion not subjected to this severe service is still sound and unmarred, but it could not stand the strain of the successive freezing and thawing, with the destructive stresses that action induces in the walls of the minutely porous concrete surface. Such deterioration is not uncommon in dam faces in northern climates but the extent of the damaged surface was here increased by the fact that the thin concrete wall of the arches permitted the cold to penetrate to the water face and thus form ice far below the comparatively shallow ice cover of the reservoir. This is a new danger in such dam design which should be noted. And with it should also be noted that for some forms of service concrete has to be made more dense than is demanded for mere strength requirements, which means that all the care possible in analyzing aggregates, in proportioning the mixture and in mixing and placing the concrete is none too much.

Use the Shovel

WITH the new developments in graders, planes, drags and more complex machines for road maintenance we have run into the danger of overlooking the old short-handled shovel. It is pleasing therefore to note that B. H. Piepmeier in his exceptional article in this issue on earth road maintenance lays stress on the shovel as a patrolman's tool. Mr. Piepmeier doesn't say to hang a shovel around every patrolman's neck but he does urge that one should be tied to every drag or grader or other machine that goes out to work on the road. And he demands that it be frequently untied and used. The Missouri road engineer, as his article fully proves, is the last one to ignore improved machines for earth road upkeep, but he knows that a frequent shovelful of dirt timely placed and spanked down with the shovel bowl will do more to keep a dirt road in surface than infrequent heavier earth moving by power machines. This is the secret of good maintenance of all roads—the hard surface as well as the dirt surface.

A Sore Spot in Labor

THERE is nothing that so alienates the sympathies of the contractor away from union labor as the jurisdictional strike. The contractor-employer and the engineer-supervisor, both of whom are interested in getting construction done as cheaply and as quickly as possible, understand and can deal with the strike for better hours or higher wages. Those are issues between employer and employee which are subject to

discussion and settlement between them. The employer may disagree with the employee and may think his demands unreasonable, but at least he can understand the desires that are back of the demands and can realize that if the demands are valid he, as the employer, has certain responsibilities therewith. Not so with the jurisdictional strike. In that the employer, the engineer, the owner, and the general public, are innocent bystanders who pay the bill while two different sections of organized labor squabble as to which shall win an argument, the settlement of which is of no importance whatever to the public and which cannot in any way increase the efficiency of building or reduce its cost. The jurisdictional strike is the sore spot in organized labor, and the damage to its whole body is bound to come, if labor itself does not soon find some remedy. Just now in the building trades certain bricklayers and plasterers are holding up millions of dollars worth of structures on the whole East coast because in the grand rush of the building boom in Florida some agreements as to unions there have come into controversy. So far even the Secretary of Labor has not been able to settle the trouble. Such arrogance can be carried too far. Labor must be able to clean its own house if it is to have any standing in the management of the common dwelling.

North Dakota Upholds Zoning

THE broad view of city zoning shown by a North Dakota judge in a recent decision is all the more impressive because of the small urban population in that state and the particular zoning restriction at issue. Although there were only six cities with populations of 5,000 or more in North Dakota in 1920 and none with a population reaching 22,000, the legislature of 1923 passed a zoning enabling act. Bismarck, the city whose zoning ordinance has just been upheld, had a population slightly above 7,000 in 1920. True, no question of size entered into this case, but it is significant that in so sparsely populated a state the legislature has authorized zoning and that when its constitutionality was questioned two successive judges should uphold it as a matter of public welfare in a case where the issue was the setback from the street line, basing the decision on general welfare, in which it stated that the defendant himself would share, and recognizing also that the "building line provision of the zoning ordinance adds to the beauty and convenience of the whole community." That this is good constitutional law in sparsely populated North Dakota and apparently is not in an urban and suburban state like New Jersey, shows how far we have yet to go to establish the real future of zoning restrictions.

Where to Put the Concrete

IN AN article urging better design and construction of pipe sewers, elsewhere in this issue, an experienced Canadian engineer ably considers practice in the use of concrete for greater stability and integrity. Questions voiced by his article that deserve widespread attention are where to put the concrete and whether with pipe entirely cased with concrete plain end pipes cannot be used advantageously instead of bell-and-spigot pipes, as has been standard practice at Washington, D. C., except that there on the upper third of the pipe the concrete surrounded the joints only.

Bridges and Traffic Safety

A GOOD deal remains to be done before highway bridges will have reached that ideal state in which they afford the same degree of safety to traffic as other portions of the road. The present-day demands of safety in highway traffic are of very recent growth, and it could hardly be expected that the thousands upon thousands of horse-and-buggy bridges which still survive would be altogether satisfactory in service under dense thirty-mile-an-hour motor-vehicle traffic. Accordingly we are troubled today by great numbers of narrow bridges, slow-speed bridges, bridges located on curves or at impossibly awkward jogs of the road, trusses or girders so placed as to invite endwise collision, low roadway curbs, unprotected truss members, and weak railings—not to mention such minor botherations as caving approach banks, abrupt jumps at entrance and exit, and bad spots in the bridge floor that force traffic out of line. This undesirable condition is due to development of traffic, not to bridge engineering neglect; nevertheless it is a bridge engineering problem to deal with.

That bridge dangers cannot be allowed to continue indefinitely is emphasized by current accident news. Last week, for example, the reports at hand tell of a number of motor vehicles breaking through bridge railings. The details indicate that in each case the accident was due in part either to the driver's neglect or to some factor other than the bridge; and yet, but for the presence of the bridge there would have been no accident to speak of. The bad driver and the incidental causes of accident will always be with us; it is not necessary that the bridge too should continue as a cause of accident.

In the District of Columbia a passenger car swung inward in order to cross a narrow bridge; it scraped a central trolley pole, was thrown crossways of the road, and went straight through the opposite bridge railing, landing in the deep ravine below. In Massachusetts there is a bridge that was investigated as to traffic safety only a few months ago, after an accident; last week a truck climbed the curb of this bridge and ran into the sidewalk balustrade, knocking out a length of it. In New York, a car while traversing a country road bridge caught the wheels of a passing car (narrow bridge?) and went overside into the river. These same causes, if they had operated on the open road instead of on the bridge, would probably have had no very serious result. The bridge not only contributed to the causation of the accident, but made it much worse in its effects.

What, then, are we justified in expecting of a bridge in the matter of safety? It may fairly be expected that a bridge shall not create a danger spot in the road. It should not offer special hazards and difficulties to traffic. In addition, however, the bridge should not make an ordinary accident worse than it would be on the open road. Accordingly, whatever guarding is necessary to prevent striking the trusses or going over the rail may reasonably be demanded as a proper safety provision. The second requirement is of added importance in those cases where the first cannot be fully met. Thus, if because of bad alignment or narrow width a bridge is inherently a danger-point in the road, it ought to be specially guarded at approaches, trusses and railings. Guarding and signaling can do much to coun-

teract the hazards arising from unfavorable construction or location.

It is the function of a bridge to carry a road and its traffic across a depression. This function is not performed efficiently according to present-day standards unless the traffic is served conveniently and without delay or slowdown. From the viewpoint of the passing traffic, the bridge does not exist, but is merely part of the road; it is satisfactory if it performs as well as other parts of the road, and is objectionable if it constitutes a danger spot or obstruction.

Modern traffic conditions emphasize this view to the degree of making it controlling. Former generations could tolerate having their bridges designed to suit the conditions of the stream or the convenience of property owners or bridge constructors; the road would find its way to and over the bridge somehow. But today it is essential that the bridge be designed exclusively from the standpoint of the roadway, in order that it may be an efficient integral part of a through traffic route. Stream and structure are secondary considerations.

Individual bridge designers have taken some such view of their problem for years past, and have dealt with location, alignment and profile, pavement, and guarding, in the light of traffic requirements. The old view, while maintaining its ascendancy, has been losing ground slowly but steadily. In measurable time, we believe, the newer view will become fully established under the pressure of growing traffic needs. New bridges, therefore, will be built to meet modern demands in full. The condition of old bridges, however, will long remain a formidable problem. The improvement and safeguarding of these structures puts a difficult task before the highway bridge engineer.

Growing and Changing

CONTINUING what has become almost a habit, we note here the gratifying fact that last week's meeting of the American Society for Testing Materials showed that organization to be fully up to its accustomed standard of activity and growth. Its meeting was occupied not only with its own work but also with that of a number of other societies—for these post-commencement meetings have gradually come to be a center of activity for technical committee work of many kinds. As a quantitative measure of development we have the fact that the A. S. T. M., with a remarkably consistent growth, is now approaching a total membership of 4,000, and that its standardization work has been increasing proportionately in amount. But while remarking on this growth we are bound to note also the changing direction of the society's standardization work which has become noticeable in recent years, most distinctly so at the meeting just closed.

The work is trending away from the materials that occupied the center of the stage in past years, the basic bulk materials like steel, timber, cement, and it is turning instead toward specialized materials—textiles, petroleum products and the like. This trend showed strongly in the relative appeal of the proceedings dealing with these respective classes of material; the reports and sessions dealing with specifications for the older materials were relatively dead, the others were brisk and interesting. These changes are the natural sequel of growth and development. The pioneer work on the primary materials has been fairly well completed; there will be need for continued work in the way of refinement, of course, but there are not likely to be further battles over major questions until new developments in materials, methods of production or quality come to pass.

What has been achieved in the field of these materials, however, laid the foundation for specification work in many other fields, previously without standards and without recognized methods of quality comparison. The extension and change of the society's work thus is the proper outgrowth of the society's own activity, and inevitably reacts upon the organization to bring about a slow transformation. This transformation promises to continue as the processes of standardization and quality comparison by test are carried over into other parts of the field of industrial materials and products.

Questionable Activity

RELATIVE merits of two clay products, brick and hollow building tile, are receiving an unusual amount of free advertising in Chicago, because of the fight put up by the brick interests to keep out tile, or should we say the fight put up by the tile people to modify the building code and let them in. So far the bricks have it. At first the building and zoning committee reported to council favorable changes, removing ambiguities as to tile and permitting their use in walls up to 40 ft. Council passed the ordinance, but Mayor Dever vetoed it on the grounds that the Bureau of Standards had a report the committee had not considered. Thereupon the brick people "got busy" and the committee has twice brought out an unfavorable report despite the entreaties and threats of the mayor who really wants tile let in.

The best architects and architectural firms in the city, the American Institute of Architects and Western Society of Engineers are aligned against what the committee calls "recognized authorities" consisting of the president of a brick company and head of the local brick association, a contractor for the repair of small buildings and an out-of-town architect employed by a brick manufacturers' association and a former building inspector, boiler and automobile salesman. William Artingstall, consulting engineer to Col. A. A. Sprague, commissioner of public works, has reported favorably to the ordinance, analyzed the alignments and generally given help to the administration that is a credit to the engineering profession.

Building code activities of material associations are necessary if their business is to be promoted. They rarely come to the surface, but when they do under such conditions as in Chicago it is unfortunate for them. The Chicago code should be amended to permit the proper use of tile. That goes without saying. Whether or not the ordinance now proposed is absolutely correct, it is susceptible of simple amendment to allow tile to be used as it is safely and efficiently used in many cities. For a brick association to succeed in keeping out of use such a competitor has ominous connotation both for the association and for the city council that is influenced so to act, especially when that council has the advice of unprejudiced engineering and architectural societies and of government bureaus which would lead it to permit the use of this competitive material.

American Society for Testing Materials Meets

Large Attendance and Active Work on Standards and in Discussion of Materials Specification—Work Shifting to New Fields—Research Emphasized—In Memory of Merriman, Dudley and Marburg

A MEETING of vigorous activity was held by the American Society for Testing Materials at Atlantic City last week. The proceedings covered a broad range of materials-specification work and discussion of test phenomena and of the behavior of materials. Some of the more recent annual meetings gave occasion for comment that the work of the society was tending toward a routinization fatal to sustained interest, but the present meeting was proof that the society is carrying onward its past record not only of steady growth but also of increasing activity.

An attendance surpassing that of any previous meeting, with a total of about 868 men and 250 women, and remarkably well maintained close interest in the proceedings were concrete expressions of the success of the meeting. Moreover, in spite of a shortage of printing funds due to extra expenditures last year, the management was able to present 35 committee reports and almost as many papers. The work on new specifications and revision of existing ones showed proportionate growth. It was interesting to note a tendency for the specification work to shift into new fields, however—away from the better known bulk materials to special materials and composites, or in a sense away from engineering materials to specialized industrial materials. Thus, rails and structural steel are at present relatively less important in the society than such materials as rubber disks for fire sprinkler heads, Muntz metal condenser-tube plates, and bolting material for high temperature service.

A number of papers of decided importance were read, representing a noteworthy advance in the investigation of materials and test methods. In part these will be noted in the following report, and in part abstracts will be presented later.

Aside from its official sessions, the meeting had a wholly independent importance as a gathering place for committees, not alone from the American Society for Testing Materials but also from related societies. During the week some 120 committee and subcommittee meetings were held. These added to the 10 sessions of the society made the entire week's work decidedly businesslike and efficient.

Retiring president F. M. Farmer addressed the society on the subject "Promotion of Knowledge of Engineering Materials." He analyzed the steadily growing demand of production for better knowledge as to the properties of materials and their efficient use, and the need of systematic work such as that done by the society to supply this knowledge. Considering then the machinery of the society as the means of carrying out this function, he showed that while the official cost of its conduct is only $80,000 per year, the actual cost approaches $300,000; that increased income as well as increased promotion is necessary; that the work of the society is a significant factor in our industrial progress, and that with the steady change in the conditions of production it is becoming steadily of greater importance to the country.

W. H. Fulweiler, chemical engineer of the United Gas Improvement Co., Philadelphia, was elected president for the coming year, and Prof. H. F. Moore, University of Illinois, vice-president.

Mansfield Merriman Honored—The recent death of Mansfield Merriman, one of the founders and an early president of the society, was officially taken note of, and the meeting adopted resolutions in memory of his services to the engineering profession. Two other departed pioneers of the testing field, former president Charles B. Dudley and former secretary Edgar Marburg, had memorials established in their memory—the Dudley Medal, to be awarded each year for the best paper advancing the knowledge of materials, and the Marburg Lecture, to be delivered annually by an outstanding authority in some field of materials research. An enthusiastic vote of the meeting approved the establishment of these memorials.

Specifications

In view of the large amount of work dealt with at the meeting and the extensive field covered, only some greatly condensed notes of the more important specification work can be given here, arranged to suit the convenience of the reader without regard to the order of presentation at the meeting.

Cast and Wrought Iron—No new specifications on cast iron were presented and in general little progress shown. A yield-point value (30,000 lb. per sq.in.) was added to the specifications for malleable castings, and a new size of "arbitration test bar" for cast iron (1.2 in. diameter by 18 in. test length) was proposed.

Specification work is inactive also in wrought iron, but an extensive investigation of heat treatment, including the annealing of iron chains in service, is being undertaken by the committee.

Steel—Three important new specifications were approved: Structural silicon steel, castings for high-temperature service, and bolting material for high-temperature service. The subcommittee on automotive steel has been discontinued. Aside from new problems connected with material for high-temperature service, several important papers on this subject being read in connection with the committee report, its activities are largely routine revision of existing specifications.

Ferro-Alloys—Six specifications were submitted and adopted: Spiegel, tungsten powder, ferro-chromium, ferro-silicon, ferro-manganese, ferro-vanadium. Methods of sampling and analysis were also formulated and approved as tentative.

Research on the subject of tin in high-speed steel, which is closely related to the work of this committee, was recently organized by the society under a special committee.

Some discussion developed about the disintegration of ferro-silicon during and after shipment, which is not covered in the proposed specifications. The difficulty appears to affect chiefly material of silicon content between 50 and 60 per cent.

Heat Treatment—As a substitute for an existing specification on heat treatment of case-hardened steel,

a new specification was proposed and adopted, recommended practice for carburizing and heat treatment of carburized objects. The committee has dealt with definitions of heat treatment terms, and proposes to take up this subject through a joint committee with two other societies.

Non-Ferrous Metals—The copper wire committee reported having reached agreement with the electric railway interests on the specification requirements for hard-drawn copper trolley wire, and presented the results, together with a specification for bronze trolley wire. Its other activities are limited to revision work.

The committee on non-ferrous metals and alloys is quite active in the study of high-strength light aluminum casting alloys, ingot material and the like. It reported a specification for Muntz metal condenser-tube plates, aside from minor revision work. It submitted also a paper on the world's antimony situation, by H. K. Masters. Two other papers of much importance dealing with non-ferrous metals are noted farther on.

The committee on screen wire cloth is also occupied exclusively with non-ferrous material. It has started a large series of exposure tests of 16-mesh non-ferrous mosquito screen, to be paralleled by laboratory studies of the materials. Seven materials and three types of frames will be represented, making 21 panels to be exposed at each of four locations (Pittsburgh, Panama, Portsmouth, Va., and Washington).

Metallography—A recommended practice for thermal analysis of steel was presented by the committee and approved. Important subjects under study are on micro-hardness, micrography of aluminum alloys, and X-ray crystal analysis. A number of papers on micrographic practice are in course of preparation.

Corrosion—The two committees on corrosion of iron and steel and corrosion of non-ferrous metals are not engaged in specification work, but have recently begun corrosion exposure tests of remarkably large scope, following the extensive exposure tests of bare ferrous metals in progress during the past ten years and now practically completed.

Results of the bare iron corrosion tests during the past year have confirmed the previous results. In atmospheric exposure additional failures occurred earliest in those groups of plates composed of non-copper-bearing metal. The total immersion tests, which do not show the same result, are not yet at a conclusive point, but it is reported that light-gage sheets immersed in brackish water at Annapolis show about 40 per cent longer service than similar sheets exposed in city water at Washington and about 26 times the service life of sheets immersed in mine water. The tests are to be extended to include immersion in ocean water.

The new program of tests which this committee has just initiated deals with metallic coatings on iron and steel sheets (see outline of tests, *Engineering News-Record*, March 26, p. 536). Two important papers on corrosion were presented, concerned mainly with the problem of accelerated tests. This question gave rise to some animated discussion at the meeting, with the usual disagreement of view as to the importance and interpretation of accelerated or controlled corrosion testing.

Ceramic and Mineral Products

Coal and Coke—Slight revisions in specifications were presented. Work is in progress on grinding of samples and on size testing of anthracite.

Slate—Although formed only last year, the slate committee presented two specifications—test for water absorption and method of flexure testing—and reported work in progress on the subject of hardness, toughness, and absorption. It is compiling experience data on weathering, largely on a statistical basis.

Refractories—During the past year the committee's previously formulated test for slagging action of refractories was found unsuitable, and with the approval of the meeting it has therefore been withdrawn. The committee is now giving its main attention to the study of the special service required of refractories in various industries. Summaries of two such studies were reported in the form of papers by G. L. Morehead on malleable iron and F. A. Harvey on by-product coke ovens. A paper by A. A. Klein on the micro-structure of burned fireclays was also presented through the committee.

Brick—The specifications for building brick were virtually abandoned by the committee by agreeing to an amendment recognizing as satisfactory for use in any particular region such brick as has been in service in that region for a number of years. This action, however, bases on the fact that the society's brick specifications have not found commercial use. Aside from this, the committee approved the reduction of paving-brick sizes to four and approved the recommendation of size of sand-lime brick recently made by the Department of Commerce. It is engaged in the study of strength tests of brick, and in the gathering of data on the strength of old masonry.

Active discussion developed at the meeting on the value of absorption as a criterion for brick, and on tests for weathering resistance. This discussion embraced both brick and hollow tile (now classed under "hollow masonry building units"). The sodium sulphate test was described by Bureau of Standards representatives as being unsatisfactory. No unanimity of opinion developed on the question of proper weathering tests.

Timber—The chief work of the committee during the past year was to bring the National Lumber Conference recommendations into harmony with the committee's beliefs and previous work on specifications for structural timbers. The original classification and grading proposals before the conference discarded the density grading which the committee had formulated and the society adopted, but the committee was successful in having the dense grade recognized, and a combined density and rate-of-growth criterion adopted for structural timber of this grade. The committee reported that it is approaching the end of its revision of timber grades.

Rubber Products—Aside from slight revisions, and the presentation of a new specification for rubber disks for sprinkler heads, the committee reported that it is mainly concerned with the study of performance tests of rubber products.

Cement—Committee C-1, on Cement, has taken cognizance of the many recent demands that the standard specification for portland cement is in need of revision but "records its firm belief that the present standard provides a material which, if properly used in accordance with recognized good practice in making concrete, will produce a concrete of high quality." It did, however, recommend that the requirement for specific gravity, now an optional requirement in the standard

specifications, be eliminated. As this recommendation of the committee was not sent out to the membership sufficiently early before the annual meeting, it could not be submitted as a change in the specification and merely goes on the record as "information" this year. The same situation exists in the matter of a revision of the standard specification for natural cement, which eliminates neat cement requirements, changes fineness and setting requirements to conform to those for portland cement, and eliminates reference to the weight of the package. Protest was made on the floor by Thaddeus Merriman (New York Board of Water Supply) and E. E. Butterfield (Borough of Queens, N. Y.) against the elimination of the specific gravity requirement for portland cement, on the ground that it is a useful property on which to have knowledge.

The cement committee observed that there is great lack of uniformity among different laboratories in cement quality determinations under the standard specifications, which is due probably to variations in interpretation of the methods of test. It has therefore prepared a cement testing manual, which was presented this year, to be used by the laboratories and as text for instruction of operators. The committee believes that strict adherence to this manual will measurably reduce the discordance of results now so disturbingly evident.

Concrete—Committee C-9, on Concrete and Concrete Aggregates, has an elaborate program of work laid out but reported little but progress at the current meeting. It has made a study of the effect of divergence from the standard size and shape of compression test pieces and submitted coefficients to be applied to such out sizes when they are the only practicable ones which can be taken from existing structures for test. In this connection H. F. Gonnerman (Structural Materials Research Laboratory) presented a series of tests, to be abstracted next week endorsing the standard 6x12-in. cylinder and indicating the relationship in strength results between that specimen and others of different dimensions. E. E. Butterfield, in the discussion, reported some tests which tend to show a difference in strength of concrete cut from the structure depending upon whether the load is applied parallel to or at right angles to the direction of compaction of the mass.

Other Committees—Committees on Road and Building Materials (D-4), Bituminous Waterproofing and Roofing Materials (D-8), Lime (C-7) and Gypsum (C-11) reported on the routine changes in specifications.

Miscellaneous Materials

Preservative Coatings—This committee (concerned solely with paint) presented a series of pigment specifications, which represent an outgrowth of long continued investigative work on the part of the committee. Methods for routine analysis of white linseed oil paints and methods of testing shellac varnish were also reported, as well as revisions in some existing standards.

A test comparison of brush and spray application of paint on wooden houses was made in October, 1921, four houses being painted, two by each method. Inspection in October, 1924, showed the two brush-painted houses to be in slightly better condition than the spray-painted ones; however, "the paints applied by the spray method on surfaces of this kind appear to be equally as durable as the paint applied by the hand brush."

Two stimulating papers on paint testing were read in connection with the committee's report.

Textiles—With the organization of four new subcommittees (narrow fabrics, rope and cordage, rayon, asbestos textiles) during the past year, this committee now has 16 subcommittees. It presented three new specifications (tolerances for numbered ducks, tolerances and test methods for knit goods, methods of testing grease wool and allied fibers for scoured content), in addition to revising others and requesting the advancement of five specifications to standard. This fairly represents the activity and range of this committee, now composed of 131 members. Its report stated that "We may reasonably expect rapid progress in bringing out textile standards of every kind now that a secure foundation for and awakened interest in testing textile fabrics and yarns have been brought about."

Petroleum Products—Great activity was displayed in this field also. The committee presented six new standards, dealing with test methods for materials ranging from gasoline to cup grease, and revised a number of others. Nine subcommittees reported.

Electrical Insulating Materials—Work on insulating materials is centered on test methods, to suit the many new materials and new demands upon materials of the electrical industry. Methods for testing laminated sheet insulating materials were prepared and adopted by the meeting, and a number of other specifications were revised. The testing of varnish, of molded materials, of sheet materials and of transformer oils is under study. Additional work on tests of porcelain is expected to lead to a revision of the existing standard methods. An appendix to the committee's report, by E. A. Snyder and D. C. Cox, described the improved life test for transformer oils.

Thermometers—A new thermometer specification was reported.

Research Testing and Nomenclature—The study and standardization of general test methods have been carried on within the society for the entire quarter century of its existence, but only recently has the committee on methods of testing attacked its subject aggressively and comprehensively. In the progress of this work it has extended to quite formidable proportions. The first work has been on metal-testing methods, for which tension, compression and hardness test methods were reported last year. Slight revisions in these standards have since been found necessary. In addition, methods for flexure testing and for torsion testing of metals and an additional method for the determination of elastic limit were submitted as information only, for the present. A specification for sieves for testing purposes was adopted. The specification denotes the screen size by the width of opening in microns. As usual, the report led to some discussion of elastic limit, proportional limit and yield-point, but to no particular effect. The work of the committee on nomenclature and definitions has developed to similar breadth of scope.

Research was made a special matter of promotion and development within the society during the past few years; a committee on correlation of research was

organized during the year. Already several special research committees have been formed as a result of this movement, and a large amount of additional research work is in prospect.

Technical Papers

Brick—A review of brick service and brick specifications was presented by D. K. Boyd (Philadelphia) under the title "Brick." It constituted a destructive attack on brick specifications. Mr. Boyd asserted that the properties of the wall, not of the individual brick, are important; that absorption as a good criterion is of undetermined value; that the hardness grade of a brick is probably dependent on a combination of mechanical strength and absorption; that size of brick should be defined as an approximation; and that brick specifications should be suited to local practice.

Corrosion—Frank F. Fowle (Chicago) under the title "Accelerated Corrosion Tests on Bare Overhead Electrical Conductors," gave the methods and results of a long-time accelerated weathering test of 21 specimens of wire and strand, including copper, aluminum, copper-clad steel, galvanized iron, and galvanized steel, and combinations. The exposure was in a large box under cycles of dry air, moist air, coal smoke, and water spray, the entire cycle covering 8 hr. The test extended to 793 cycles and covered nearly a year. One of the interesting items of the conclusions drawn was that the galvanized iron and steel specimens had higher resistance in proportion to their higher carbon content.

E. Blough (Pittsburgh) in a paper "The Evaluation of Corrosion Tests," suggested that tensile strength and elongation determinations after salt-spray corrosion might give useful data supplementary to those of corrosion loss. Figures for tests on five non-ferrous metals in sheet form after corrosion up to 2,100 hours illustrated the large differences in behavior of materials which this method may bring out.

Discussion of the papers dealt largely with the difficulty of co-ordinating artificial or "accelerated" corrosion tests with natural corrosion. E. E. Thum (New York) compared fatigue and corrosion testing and demanded that a close check be obtained between accelerated and service tests. F. G. Breyer (Palmerton, Pa.) claimed that accelerated tests have independent importance, and may be made more important than natural corrosion exposure, since this in all cases is variable and not subject to standardization. Calling attention to the increasing use of accelerated-weathering boxes for investigation, he suggested that it may be desirable to standardize artificial weathering conditions, to make results comparable. F. N. Seller (Pittsburgh) suggested that corrosion tests probably deal with three separate phenomena or quantities; depth of general corrosion, pitting, and effect of the corrosive agent below the surface. The latter, presumably, is measured in the test described by Mr. Blough. H. S. Rawdon (U. S. Bureau of Standards) pointed out that where the corrosive agent produces embrittling of the uncorroded material, the action represents a real change that should be measured.

Paint Tests—"A recording Drying-Time Meter for Varnishes," by J. M. Sanderson (Buffalo), described a machine in which a funnel containing sand, mounted just above a rotating plate carrying the varnish film, deposits a streak of sand on the film, the track length of adhering sand giving a measure of the drying time. Prof. A. H. Pfund (Johns Hopkins) described four instrumental arrangements for measuring hardness, gloss, color and leveling of varnishes. For measuring hardness, the indentation of a ball is measured. Gloss is measured by the percentage of specular reflection of light at 45 deg. incidence from the surface under test; a resolving-power test, involving the reflection of two parallel wires upon the surface, and changing the angle of incidence until the two wires are seen separately, was also suggested. Color is determined by an arrangement involving the use of two wedges of amber glass. To determine the leveling power of varnishes and the time required to lose this property, an arm carrying three parallel needles is arranged to make short marks on a rotating plate at predetermined intervals. H. A. Nelson (Palmerton, Pa.) stated that close control of film thickness would prove vital to a hardness measurement such as described. Several questions on the subject of gloss indicated that the subject has some practical phases in addition to those involved in the specular reflection test described.

Copper—Tensile tests of copper were reported by N. B. Pilling (Bayonne, N. J.) and G. P. Halliwell (East Pittsburgh, Pa.) under the title "Softening of Hard-Rolled Electrolytic Copper." No definite minimum temperature of recrystallization was found, with the probability that softening at a slow rate occurs at all temperatures. Certain effects of long heating on size of grain were also described. E. H. Dix, Jr. (New Kensington, Pa.) made an interesting contribution to the knowledge of aluminum micrography in "Microstructure of Aluminum Iron Alloys of High Purity." The work described was based on aluminum of very high purity recently made available by the development of a new process for electrolytically refining aluminum on the part of the Aluminum Co. of America.

Fatigue Testing—Three important papers on fatigue were presented. R. R. Moore (Dayton, Ohio) in "Some Fatigue Tests on Non-Ferrous Metals" gave results on tests with a new type of rotating-beam machine on magnesium, aluminum, an alloy of the two, and naval brass. His results show certain high "endurance weight efficiencies," but also indicate that the best heat-treated steels have much higher efficiency. Paul L. Irwin (East Pittsburgh) gave some results obtained with the Haigh machine, in which the stress is applied by an electro-magnet, but fitted with heads of new type and using a new form of specimen. The tests made indicate that the machine is capable of giving excellent results, and so far as they go tend to show that the reversed axial stress endurance limit is equal to the rotating-beam endurance limit in the case of various steels and forged manganese bronze.

High-temperature strength of steel was reviewed by Prof. T. M. Jasper (Urbana, Ill.) in "Typical Static and Fatigue Tests on Steel at Elevated Temperatures." Results obtained at the University of Illinois Fatigue of Metals Laboratory were brought together in this paper, which, with a number of the others, we expect to present in abstract shortly. A related paper was presented by T. D. Lynch, P. J. McVetty, and N. L. Mochel (East Pittsburgh) under the title "Tensile Properties of Metals at High Temperatures Showing Effect of Stress and Time." Results of great importance, especially bearing on long-time load effects at high temperatures, were presented. Some active discussion developed on

these papers, giving additional results and bearing on some of the many unknown factors of high-temperature strength.

Asphalt Mixtures—Great interest was displayed in the matter of tests for the stability of asphalt paving mixtures. Prevost Hubbard and F. C. Field (Asphalt Association) reported a laboratory test consisting in the measure of load required to force a hot-mixed asphalt-sand briquet through an orifice. Henry M. Milburn (U. S. Bureau of Public Roads) described a test which measures the decrease in height of a specimen under constant load and constant temperature. W. J. Emmons and B. A. Anderton (U. S. Bureau of Public Roads) reported a test which measures the extrusion under load of a heated specimen through the sides of a mold. H. L. Howe (testing engineer, city of Rochester, N. Y.) told in discussion of some field tests on asphalt pavements he had made by measuring the penetration of a steel ball. In the discussion F. P. Smith (of Dow & Smith) commended these studies into the fundamental causes of asphalt pavement waving, but observed that they still were very difficult to apply to practice. "We have to balance fluidity or plasticity of a paving mixture against rigidity," he said; "if we gain the one we may lose the other." G. H. Perkins (Warren Brothers) commended this view. He said, too, that the ideal test would have to simulate more nearly road conditions of impact and pressure.

Concrete—F. H. Jackson and George Werner (U. S. Bureau of Public Roads) described a new test for determining consistency of concrete which has been tried out in that bureau during the past year. In this test a small conical hopper, of about 50 lb. concrete weight capacity, is mounted 12 in. above an ordinary spring scale which carries a circular plate of 12 in. diameter. The measure noted in the test is the weight of the concrete retained on the plate when the bottom gate of the hopper is opened and the concrete allowed to fall freely on the plate. It has been observed that the weight so retained bears a close relation to the water-cement ratio of the concrete and also to the compressive strength, much closer than was observed for the slump or the flow table results on the same concrete. Studies of the test are by no means complete but the preliminary results seem to show that the test has practical use, particularly as the apparatus is simple, portable and readily operated.

In the discussion Winslow Herschel (U. S. Bureau of Standards) said that, as a physicist and not as a concrete expert, he believed the difficulties that were being found in establishing a fit consistency test for concrete were due to the fact that a plastic material, as concrete, does not have a constant relation between pressure and rate of flow, as does a viscous or liquid material. There is no one constant of consistency, therefore. He said he offered this as a statement of physical fact and that he had no specific suggestion as to its application to concrete consistency determinations.

Alumina Cement—Tests reported by H. S. Mattimore (Pennsylvania State Highway Department) on high-alumina cement in road construction (to be abstracted next week) indicated that the setting properties of this material are such that it should not be wetted down as soon after placing as is common in portland cement. Apparently the curing should not be started until the rapid elevation of setting temperature commences, and this in alumina cement is at from 5 to 7 hours after placing. The tests showed also the customary high early strengths in alumina cement.

Cement Improvement—A. T. Goldbeck (U. S. Bureau of Public Roads) contributed a significant paper on "Requirements of Cement for Modern Highway Construction," which will appear in next week's abstracts. In the discussion J. G. Bragg (N. J. State Highway Department) said that experience in his department showed that the great need in cement manufacture was greater uniformity of the product of the same mill, as well as greater uniformity of different mills. The former, he felt, was due to lack of proper mill control, and was common in some brands. These brands sometimes fail to pass specifications from the one cause and sometimes from another, indicating that there was not one obvious fault in material or manufacture but a non-uniformity of material and manufacturing conditions. H. F. Clemmer (Illinois State Highway Department) stated that the standard tests do not reveal the rate of hardening of the concrete, which he felt to be a desideratum in a cement test. Thaddeus Merriman argued for a greater study of tension in cement and in concrete, since, he said, practically all failures in concrete are in tension and since, too, tensile resistance does not increase with age as markedly as does compressive.

Both N. C. Johnson (consulting engineer, New York) and Duff A. Abrams (Structural Materials Research Laboratory) suggested that the implication of Mr. Goldbeck's paper that cement might be improved was less important than the fact that most of the known difficulties with concrete were due to factors other than the cement.

Using the so-called "correlation method" described in current textbooks on the theory of statistics J. W. Gowen and H. W. Leavitt (Maine Experiment Stations) investigated the value of the standard tension and compression tests upon portland cement mortars and reported that the study showed that these two tests satisfy the requirements of a test in that they (1) give a quantitative measure of the most important stress to which the material will be subjected; (2) they give concordant results; and (3) they give new information and do not duplicate one another. Applying the same criteria they find, too, that a new test they have devised is a valuable addition to test information of mortar, for the determination of the value of sands. This is an abrasion test on a mortar ball, to appraise wearing quality.

Duff A. Abrams reported the tests on bond, abstracted elsewhere. Exception was taken by several discussors to the conclusions on hydrated lime in concrete.

E. E. Butterfield reported some studies in the determination of the cement content of a set concrete, which emphasized the difficulty by any of the known methods of making such determination exact.

Power on Roaring Fork of Colorado River

Seven undeveloped power sites on the Roaring Fork of the Colorado River, in Colorado, between Snowmass and the mouth of the river, have a possible capacity of 31,500 hp. for 90 per cent of the time and 54,000 hp. for 50 per cent of the time, according to the engineers of the U. S. Geological Survey. Five developed sites on the river have an installed capacity of 6,500 hp.

Engineering in the Small City

A series of notes from the field on the Problems and Practices of the Municipal Engineer in the Cities Below 100,000

The Editor Visits the City Engineer

Snapshots of Our Representative Small Cities

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New Brunswick, N. J.

COUNTY SEAT OF MIDDLESEX COUNTY, N. J. City is 31 miles from New York, and at head of navigation of Raritan River and eastern terminal of Delaware and Raritan Canal. Seat of Rutgers College and of New Jersey Agricultural and Mechanical College. Extensively engaged in manufacturing; chief products are automobiles, automobile tires, surgical and medical supplies, foundry products, chemicals, linoleums, sash and blinds, cigars, boots and shoes. First settled in 1681 and at that time called Prigmore's Swamp. New Brunswick was incorporated as a town in 1736 and chartered as a city in 1784. Pop. (est. 1924) 33,000.

IF THERE is a city engineer in any New Jersey city with a population of about 50,000 who does more work, or is responsible for the design, construction and operation of more varied engineering works than Asher Atkinson, city engineer of New Brunswick, he would like to hear of him. With a staff of but three assistants and a paving program which alone calls for the expenditure of approximately $200,000 yearly, Mr. Atkinson wields either direct or indirect control over every city engineering operation.

New Brunswick has the commission form of government. It changed from the councilmanic form in 1915. The office of the city engineer is directly controlled by the commissioner of streets and public improvements, and Mr. Atkinson is happy in the electorate's choice of his commissioner, for he is a man who sees the value of engineering advice and control for and of engineering functions. The water bureau was not, originally, under the jurisdiction of the city engineer. Maintenance of streets and operation of the garbage incinerator were originally entirely without the city engineer's purview, but at the present time Mr. Atkinson is superintendent of both the filtration plant and the incinerator, and inasmuch as he has been city engineer of New Brunswick for 26 of the last 33 years, and continuously since 1912, his counsel is weighty.

Several years ago, when the garbage-disposal plant was entirely controlled by the office of the supervisor of streets the force in charge of operation had difficulty in handling the garbage collection and thought the incinerator would not work. A different opinion was held in the office of the city engineer, and after some months of controversy the commissioner told the city engineer to operate the incinerator. It has been running in a satisfactory manner since, and Mr. Atkinson is superintendent of the incinerating plant as one of his duties.

Originally, maintenance of streets also was a function of the superintendent of streets. But the hiring of men to patch asphalt pavements who knew little of such work with a resulting overgrowth of street maintenance charges due to poor work, led the commissioner again to hearken to technical advice. Street patching is now done by competent forces, and the patches live their required life.

Acquisition of control of the filtration plant, however, was quite by chance. The city used to maintain a competent chemist in charge, but he left voluntarily, and he was never replaced. Mr. Atkinson was therefore made the superintendent of that plant, though a chemist and other attendants are employed at the plant. With such diverse duties Mr. Atkinson keeps them all under his eye by visiting both the filtration plant and the garbage-disposal plant each morning before going to his office. That every one concerned seems entirely satisfied with his control of all engineering services is attested to by the fact that his is an appointive office and he has been in office continuously for the past thirteen years.

New Brunswick presents a problem which already is acute from an engineering point of view. The city, with a population of approximately 45,000, is congested into an area of slightly more than five square miles. On the north side of the town is Rutgers College with its extensive holdings, barring municipal extension in that direction. On the south side are the New Jersey College for Women, and State Agricultural College which, with their grounds, bar progress in that direction. The Raritan River lies at the east, with Highland Park, a separate borough, confining the city to the west of the river. Therefore, the only possible direction in which the city can extend is west. It actually did acquire some 400 acres in 1917. But at the latest session of the legislature, after a hard fight, a bill was killed proposing acquisition of city territory from North Brunswick Township. Though there are two or three thousand persons in that township immediately adjacent to the city limits, who were clamoring for city police, fire and sanitary protection, loss of such population represented too great a revenue to North Brunswick Township. So the city apparently must grow up instead of out. And some unusual means must be taken to care for sanitary services of the congested areas fringing the city limits.

Such a problem was met by Mr. Atkinson a number of year ago. The borough of Milltown, with several thousand population, threatened to discharge its sewage into the source of New Brunswick's water supply. But an agreement was finally made whereby the borough system was connected to the city's by pumping station and force main. Another service which the city gives a fringe community is supplying water to Highland Park.

Another problem which has given the city engineer's office considerable worry is the tremendous through vehicular traffic that should be bypassed. There is but one bridge across the Raritan at New Brunswick and that must carry not only the local traffic but all of that passing between New York and Philadelphia. The city engineer started agitation for a bridge which would bypass through traffic, but the western end of such a structure would lead through land owned by the Women's College. Though Mr. Atkinson's office had had prepared plans and a brief showing the position

and necessity for such a structure, the project was fought by all of the woman's clubs on sentimental bases, and an opinion from the attorney general of the state to the effect that that college land could not be taken effectively stopped the project at its originally proposed location.

Eventually some bypassing of traffic must be done. The project is still alive and it is being considered by the New Brunswick luncheon clubs and other organizations. But indicative of the need for another bridge is the statement that at no street intersection in the state of New Jersey outside of Broad and Market Sts., Newark, does more traffic pass than at the busiest corner in New Brunswick. A week's traffic count has shown the passage of approximately 78,000 vehicles, with a Sunday peak of 13,000 cars, or an average of one every two seconds. When Princeton has a big game, New Brunswick gets all the New York bound traffic.

New Brunswick has a total street mileage of 59. Of this 38 miles are paved, asphalt types, with a total of 27 miles, prevailing. For the heaviest traveled streets, asphalt block, laid on an 8-in. reinforced-concrete base, has been found very satisfactory. The block are laid on a sand-cement cushion about half an inch thick. Just before the block are laid the cushion is sprinkled with water. The block are set with a sand filler, and the whole structure tied together. Even on fairly steep slopes there has been no creeping. This block has been laid since 1923, and so far has required no maintenance. Extensive resurfacing has been done throughout the city, but sheet asphalt is used, no matter what the original paving.

The city's population has increased about 40 per cent in the last decade. When it is considered that the city is so old, this growth is remarkable. Therefore it is apparent that extension of both water supply and sewer service must be not far distant. The city gets its water from Lawrence Brook, not far beyond the city limits. An impounding dam stores the water whence it is pumped to the filtration plant and into an 800,000-gal. standpipe. From there the supply is a gravity one. During the excssive drought of 1917 the water in the brook was so low that a pipe was laid over the dam and water then taken direct from the creek for auxiliary supply. The city has since put in another dam above the first to increase the storage height four or five feet.

Except for sewers in what is called the "first district" and which comprises the oldest part of the city, the sewer systems are separate. A combined storm and sanitary sewer, built 54 years ago, still serves the principal part of the business district. Sewage is discharged through five outlets into the Raritan River and the canal. Eventually a disposal plant will have to be built as the state board of health is active against discharge into the river. So far, however, no nuisance has been created by such discharge.

Traffic regulation still remains a police function. However, the city engineer buys and maintains automatic traffic signals. Whenever an acetylene-operated signal, for instance, needs filling, the police department calls up the commissioner of streets and his superintendent of streets has to fill it.

There is more tax exempt property in the city of New Brunswick than in any other city in the state save one—Princeton. It is composed of the land owned by Rutgers, the Women's College and the New Jersey agricultural experiment station, though most of latter lies outside the city limits. The only piece of taxable property within the city belonging to these institutions is the Rutgers athletic field, and that brings in a slight revenue because Rutgers derives revenue from it.

Of What Job Are You Proud?

City engineers or those in city engineering work are invited to contribute to these pages. There are doubtless many details of work, either in the office or out, whch have been formulated with a minimum of expense and time, and which would prove profitable to numbers of *Engineering News-Record* readers. Such ideas should be embodied in manuscripts for possible use in this journal. Send manuscripts to

Editor, Engineering News-Record
Tenth Ave. at 36th St., New York, N. Y.

Engineering Work

Cofferdam Built to Dislodge Cleaning Ball in Lake Outlet Sewer

By Charles A. French
City Engineer, Street Commissioner and Superintendent of Sewers, Laconia, N. H.

TWICE each year the sanitary sewers of Laconia, N. H., are cleaned by passing wooden balls somewhat smaller than the diameter of the sewer through the pipes by means of a pressure of water or sewage behind the ball. This method has been successful and economical and very seldom has it been found necessary to dig up a sewer to remove a lodged ball; but sometimes a ball does lodge. Our most recent case of lodging occurred in a cast-iron outfall pipe which carries an approximate flow of 2,500 gal. per minute.

A manhole is located about 50 ft. from the shore and 200 ft. of the outfall is beneath the surface of the lake. The invert of the outfall is about 5½ ft. below water level in the lake at the manhole and about 7½ ft. below the surface at the outlet. A 13-in. ball became lodged at a point 47 ft. beyond the manhole and various methods adopted to dislodge it proved unsuccessful. The rope attached to the ball broke when attempting to draw it back to the manhole. This same size ball has been through this sewer once or twice a year for 30 years.

It was attempted to force the ball through by means of an increase of head of 4 ft. back of the ball, with no effect. Jointed wooden and iron rods would not dislodge it. Wooden sewer rods could not be forced by the ball to get a line through the sewer.

The method which proved successful was this: The ball was accurately located by means of jointed wooden rods. A cofferdam 7 ft. long and 6 ft. wide was put down to the bottom of the sewer. A 4-in. gasoline diaphragm pump was sufficient to unwater the excavation. An electric power line was run about 500 ft. from

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a neighboring factory and an electric drill with a ⅜-in. bit was procured. An opening about 14x13 in. was outlined on top of the pipe and holes as near together as possible were drilled through the pipe around this outline. Each hole, as drilled through, was stopped by a wooden plug. A ½-in. steel plate, large enough to cover the opening cut in the sewer, was bent to fit the outside of the 15-in. pipe and two steel bands made in two sections with flanges to bolt together were provided. The plate and bands were placed in position around the sewer ready to be slipped over the opening. A diving apparatus was hired and a tapering wooden plug was driven in the outlet end of the outfall.

At 4 a.m., when the flow of sewage was at a minimum, the cofferdam was unwatered, the opening in the sewer broken out and the ball removed. It was found that the ball had lodged against a water-logged pine knot, crescent shaped, about 15½ in. long, conforming to the circumference of the pipe in outline, shaped just right to wedge the ball solidly. Two 4-in. gasoline diaphragm pumps kept the sewage down so that the plate could be slipped over the opening, clamped tight and the edges calked with a sheet lead gasket. A wooden box was built around the cut in the sewer, the water pumped out and the box filled with concrete, resulting in a tight and permanent structure.

Houses and Pavement on Sanitary Fills in Seattle

AFTER several years' experience with fills made from city refuse in Seattle, as described in *Engineering News-Record*, Nov. 23, 1922, p. 876, C. L. Murray, superintendent, Seattle garbage department, reports that residences and street pavements put on such fills have not shown cracks or other evidences of settlement.

Mr. Murray makes the following comment on the sanitary fills: "There is a great difference between the fills made in summer and those made in winter. In summer the material used is light, bulky and free from ashes, usually giving a settlement of at least a foot in the first six months. From that time on the settlement is slower but is both increased and hastened if heavy vehicles drive over it. On the other hand, a fill that is made during the cold months of the year will not settle over six inches in the first six months and thereafter settlement is very slow.

"A fill that was made four years ago in a ravine 40 ft. deep, using only wintertime refuse, has now had a $5,000 residence on it for a year. After a thorough examination no evidence of settlement whatever was found in this residence. In this case, the foundation was a concrete wall 7 ft. high, 18 in. wide at the base and 6 in. wide at the top.

"In another case two residences were built on a piece of property on which a 20-ft. fill had been made from the ordinary run of city refuse collected in winter. This fill stood for three years before being used for building purposes. The houses have now been occupied for three years and show no evidence of settlement.

"The city has laid concrete pavement in several instances on sanitary fills, open to the use of the same unrestricted traffic that uses other city streets. No special thickening of the paving was used in these cases, the usual city standards prevailing.

"In addition to the foregoing notes as to the stability of these fills, it may be interesting to observe that the city has never had to pay for the privilege of using private property for disposal of city refuse in this manner. On the contrary, there have always been more property owners who desired to have fills made on their property than the city could accommodate with service of this kind. At the present time the department has more applications on hand from property owners than ever before. One of the fills now being made, on petition of the property owners, is in a ravine that cuts through twelve lots, eight of which are occupied by residences in the $5,000 class."

Reclaiming Tidal Flats for Residential Property

WATERFRONT property in the city of Norfolk, Va., is always at a premium for home sites. As such a large percentage of the city is tidal flats, considerable effort is being made by private interests, mainly real estate concerns, to reclaim what tidal flats it is assured can be turned into profitable real estate. The principal method followed is construction of pile and timber bulkheads behind which is placed hydraulic fill. Dredging is done immediately adjoining the property to be developed, so the channel of the estuary is thus benefited.

The hydraulic fill is first brought to approximate finish grade and then left to settle for weeks or months, as may be necessary. Shrinkage of the material is often so great that more filling is placed. Eventually the fill becomes stabilized and the property is improved and placed upon the market.

In order to make available for home sites and assure certain sanitary control in a portion of the city recently acquired by annexation, Norfolk is contemplating the installation of a series of gates at a principal control point and culverts for spilling so that approximate high water may at all times be maintained with the controlled area. The actual water area contained in this project is around 900 acres. The project contemplates the control of the water of the Lafayette River east of Granby St. in the northeastern part of the city. Work will embrace the construction of a fill or dam at the river crossing at Granby St. with special locks for water control and a bascule span; and from the major arms of this river construction of concrete culverts leading into Ohio and Crab creeks, thence into the Elizabeth River. At these culverts will be installed controlling devices so that salt water in large quantities would flow in one direction from the tidal basin through these culverts, flushing them and the creeks into which they empty. This plan would maintain the surface of the water practically at high tide (the tidal range is about 3 ft.). Constant renewal of the water would mean easy sanitary control and economical development of the property for residences.

The project has been recommended for construction by the director of public works, and definite action upon that recommendation will be taken at an early date.

Everyday Detail of Earth Road Maintenance

Build Earth Roads So That They Can Be Maintained and Then Keep Them Up by Constant Small Repair Operations—What the Quality of the Men and the Kind of Equipment Should Be

By B. H. Piepmeier
Chief Engineer, State Highway Commission, Jefferson City, Mo.

By the most liberal calculation there are half a million miles of surfaced roads in the United States and in round numbers there are three million miles of road of all kinds. With the best we can expect of road improvement we shall have with us for long years the earth road as our main highway type. An article on earth road maintenance does not then require apology even when directed to engineers. This particular article is peculiar in the fact that it is a lesson in the everyday routine details of up-keep as they have been learned by a highway engineer who has been raised and educated and, all his life, has worked in dirt road states.—Editor.

EARTH in its many different formations can be shaped and reshaped to provide a road wearing surface that will serve and in many cases satisfy traffic. Traffic above everything demands a smooth and safe surface. It will put up with intervals of mud, but it must have a smooth riding surface a large portion of the time. Therefore the chief problem confronting the earth road builder is to provide a surface that can be kept smooth the maximum time under the conditions that will be imposed. An unprepared earth road is very difficult to keep smooth. First, then, it is necessary to prepare (grade or construct) the earth road.

Erosion and underground, or subsoil, moisture, have been and will continue to be the outstanding enemies of earth roads. Both can be materially reduced by careful location. In fact many existing earth roads must be completely relocated if they are to be maintained as earth roads for any great period of time. If it is not possible to relocate and avoid the bad places, a very extensive study of the existing road location should be made with the view of properly draining the seepy places and adding some form of protection to the places that are subjected to excessive erosion. Many seepy places may be remedied by arching them over with a heavy layer of porous soil. Excessive erosion can also be more or less controlled by constructing a flat crown and by retarding the flow of water in the road. Excessive erosion in ditches can be prevented by depositing brush, straw or rock in the channels, by oiling the earth, or by constructing retards, such as small dams at frequent intervals.

Maintenance—In the end, however, the success of any earth road depends very largely upon its maintenance. *A poor earth road kept maintained is better than a properly built earth road that is not maintained.* Without patrol maintenance good earth roads are not possible, even if they are carefully constructed. Maintenance, moreover, should not only keep the earth surface in its original condition, but should try to improve that condition by gradually building up the type of surface, the width, cross-section, shoulders, ditches, and general appearance of the right-of-way.

Developing the Surface—An earth road, after grading, is not finished until by the repeated use of a drag or blade, the earth has been mixed with water, puddled, and spread over the traveled way, so that when dried it will form a molded crust. Everyone is familiar with the fact that a hog, when turned loose in a dry field, will, within a short time cut out and puddle a basin that holds water like a tub. If such a basin is allowed to dry, it is found that the lining consists of a strong impervious crust. Likewise, by consistent maintenance operations, aided by traffic, an impervious crust may be developed on a road. The more consistent the maintenance operation, the thicker will the crust become and the more impervious to the elements and to the action of traffic.

Earth road patrolmen should be equipped and ready to drag or blade the surface as soon as possible after each rain. Maintenance work must be done promptly after rains and continuously between them.

However well maintained, the surface of an earth road may break up during bad weather and wear down under the action of traffic. Due to this fact, new material must be added from time to time. Care must be exercised to obtain the best material possible. Sods, turfs and other vegetable matters should be kept out. All holes that may develop should first be cleaned out and then filled with the *same kind of material as that composing the surrounding surface.* Stone, gravel, etc., should never be dumped into holes, because this practice makes the repaired surface stronger than the surrounding surface, and the result is a bad looking place, forming a bump in the road. It is difficult to maintain such places and usually two holes develop in place of one—one on each side of the repaired hole.

Drainage—If a soft spot develops in an earth road it is due to poor drainage, poor soil, or both. Sometimes the trouble can be remedied by proper side drainage or the placing of a culvert. At other times a subdrain must be provided. A careful investigation is usually necessary to determine what type of subdrain is best. Some soils have poor supporting qualities even when only slightly wet. In such cases, the soil should be removed and suitable top soil used to fill the hole. If the undesirable soil is deep stone may be used to provide a supporting base, which should be thoroughly covered with suitable soil.

It is important to know when gravel and stone should and should not be used. Never dump gravel or stone into a mudhole. Drain and clean out the hole and refill with top soil; then, if fine gravel or stone is available, it may be spread uniformly and thinly over the entire surface. Rock may be used to strengthen weak foundations, but should be placed deep and should always be thoroughly covered with good soil. Then if available, fine stone or gravel may be advantageously spread over the surface.

During certain unfavorable seasons a few bad spots are very likely to develop in any earth road. Planks

and timbers should be kept conveniently at hand and *used in building plank runways across such places.* Plank troughs laid on logs or crossties will serve traffic until such time as weather conditions will permit a more permanent repair.

As previously stated, earth road maintenance should be a developing process. Some soils can be maintained in a fairly satisfactory manner, but many soils are not naturally maintainable and must be modified. It is necessary to add clay to a sand road, and it may be necessary to add either clean gravel or sand to a clay or gumbo road. If sand or gravel is not available, suitable top soils may be used. Whatever material is added to the road to make it maintainable, *should be added at the weakest points first, and only in thin layers.* Gravel or stone added to the road should be small enough to pass a 1½-in. square mesh screen. No attempt should be made to gravel-surface any large portion of an earth road until the road has been well graded and drained. Placing gravel on a poor dirt road results only in a poor gravel road. The time will soon arrive when conditions will demand that the road be graded, with the usual result that the greater portion of the surfacing material will have to be sacrificed.

On earth roads, drainage is essential. Ditches must be kept open. Usually, at least an 8-ft. grader must be used early in the spring and in the fall to open ditches. In the meantime, the patrol grader should be used frequently to keep ditches clean and free from weeds, and other vegetation. *No vegetation whatever should be permitted to grow in ditches, on inside ditch slopes, on the shoulders, or the surface of the road.* In dragging or blading the operation should extend from shoulder to shoulder. False or secondary ditches should not be allowed to form on the shoulders.

When grading a road, or when opening ditches, care should be used to obtain straight shoulder and ditch lines. A uniform width between shoulders should also be obtained. Wide places should be cut narrower, and narrow places widened so that the roadway width will be uniform throughout a definite length. This provides for the safety of traffic, adds to the appearance, and provides for more convenient maintenance.

Hard-surfaced roads are built under specifications, and the materials and methods used are uniform, with the result that a uniform product is obtained, which can be maintained in a more or less uniform manner. On the other hand, the materials entering into earth road construction are used as found. An earth road may be composed of all kinds of soil from light loams to boulder-infested gravels, gumbo, clay, hardpan, gravel, sand, etc. Sometimes almost the entire list is encountered on one patrol section.

Equipment for Maintenance—Earth road patrolmen must possess indomitable courage, with a sense of humor necessary to carry them through the inevitable discouraging periods. They should take pride in their work, but never be satisfied. A good earth road patrolman should not be discouraged after spending six days polishing the surface of his section, if on the seventh day it rains and his dream is transformed into a nightmare. Neither should he resent it if, in such cases, the traveling public berates him loudly because the road is not in good condition for their Sunday afternoon spin. Briefly, the most important piece of equipment for the patrolman is determination to keep his road in shape.

Proper road equipment for earth road maintenance is important. The class of equipment varies, however, according to the character of soil and the volume and kind of traffic. Light patrol graders and drags, pulled by three or four horses, are satisfactory for use on light soils. Team patrols are particularly desirable on earth road maintenance where soils are light, where considerable slip scraper work is necessary, and where gravel or other surfacing material may be conveniently obtained from the nearby streams and fields.

The team patrol is practically useless on heavy soils. Soils that rut and cut up badly when wet, then dry quickly, require the use of heavier equipment. The various sizes of drags and maintainers are all found to be useful under various conditions, *but the 4,000- or 5,000-lb. blade grader is probably the most universal and indispensable maintenance machine for earth roads.* In some cases, where soils are unusually heavy, even heavier machines may be necessary.

For ideal earth road maintenance, ample men and equipment should be provided to drag the surface completely in eight or nine hours. Often this is not possible due to lack of sufficient funds to provide both men and equipment. Usually, heavy soils will not be in shape to drag or blade before 10 a.m. or noon the day following the rain. Consequently, if the road is to be dragged at the proper time, the patrolman necessarily must work until late. It is always desirable that the patrolman live as near as possible to the center of his section, thus permitting a thorough smoothing of at least a portion of his section before nightfall. A wide-awake patrolman soon learns which part of his section dries fastest, and makes an effort to get to that part first.

In the summer season the drying period is short. Too often the road dries and bakes before the patrolman can make his round. In the early spring and through the fall and winter, the drying period is much longer.

Maintenance Methods—No earth road should be worked after the surface becomes hard and thoroughly baked. Scraping or honing a rutted dry road is futile; little is accomplished thereby except to wear out the equipment and waste time that could be more profitably devoted to other important work. Furthermore, such practice may actually damage the road by breaking up the crust, later to be blown and washed away. After the surface becomes thoroughly baked, it is recommended that ruts be filled with dirt obtained from the softer shoulders, or from ditches, if fully dry. Dirt thus cut from a shoulder must be replaced at the first opportunity, in order to maintain the proper cross-section. This is an emergency treatment, and should be avoided by the patrolmen making special efforts to get on the job sooner after each rain.

In maintaining the surface, only enough dirt to fill the ruts and holes should be cut. When using a blade machine the heel of the blade should be lifted one or two inches above the ground, and the dirt thus permitted to drift and feather out under the edge of the blade. Dirt rolling around the end of the blade, and leaving a windrow to impede and endanger traffic, is a sure indication of too heavy cutting. Excess cutting produces needless loose material which will dry and make dust, or form more mud in case of rain.

Another most important road tool, too infrequently used, is the common slip scraper, or the fresno. The traveling public cares little about the condition of the

road between impassable mudholes. A road which can be traveled the entire distance is the important feature. Nine times out of ten the places that break through and become impassable, when the rest of the road is good, are preventable. They can be prevented by the intelligent use of the slip scraper, and by that means only. The road grader is a valuable piece of equipment, but the slip scraper is indispensable, and must be used to supplement grader work.

The shovel and pick are the most important of the hand tools. A big job is only a series of small ones. Small things must be watched. A small wash or hole may be filled with two or three shovels of dirt today, tonight it may rain, tomorrow the wash will become a gulch, and the hole an impassable bog. *The shovel is so important that all patrolmen should be required to carry it on drags and graders at all times.* Carrying a shovel will not suffice; it must be used. Even when the road is too wet to drag, the patrolman should walk his section with pick and shovel in hand and drain water from ruts, open ditches, etc., thus giving the road a chance to dry more quickly.

The changing of men, or the switching of men from one section to another, should be avoided in so far as possible. Each section has its own peculiar characteristics that are best learned by association. The longer the patrolman works on a section, the more thoroughly he becomes acquainted with the features of that section, and the more fitted he should become to cope with the problems of keeping his section in first class condition.

Progress in Study of Education of Engineers

Report of S. P. E. E. Investigation Gives Results of Studies of Graduates and of European Schools

AT THE recent meeting of the Society for the Promotion of Engineering Education at Schenectady, N. Y., reports were presented by the Board of Investigation and Co-ordination which, with a grant of funds from the Carnegie Corporation, is making a study of engineering education. The results were presented in a series of topical reports preceded by general explanations from the chairman, Prof. Charles F. Scott, Yale University, and the associate director, Prof. H. P. Hammond, Brooklyn Polytechnic Institute. Professor Scott explained that the work began three years ago with the appointment of a committee of the society to make a general study of engineering education. After plans had been formulated and approved by representative educators, the Carnegie Corporation was approached and agreed to finance the investigation to the extent of $108,000 for a period of three years. W. E. Wickenden, then acting vice-president, American Telephone & Telegraph Co., was appointed director.

The work was organized promptly after the authorization, and information has been collected by means of questionnaires, with the co-operation of the national engineering societies, more than a hundred educational institutions, and other agencies. Nearly 150,000 individuals have contributed a half million items of information and the results have been tabulated and studied. Numerous colleges have been visited, in this country and abroad.

The major purposes of the investigation, as explained by Professor Hammond, are: (1) To clarify the educational functions and responsibilities of the colleges of engineering; (2) to establish guiding principles for the content and arrangement of curricula and the improvement of teaching; (3) to consider in what ways problems relating to engineering students, graduates and teachers may be dealt with more effectively; (4) to examine the practicability and possible benefits of closer group relationships among the colleges and with the professional organizations of engineers; (5) to make an analytical comparison of the organization and practices of engineering education in Europe and America.

After preliminary study it appeared that the elements to be studied were: (1) Engineering students, their antecedents, characteristics and preparation; (2) admissions procedures; (3) teachers and methods of teaching; (4) engineering curricula; (5) engineering graduates, their careers, experiences and opinions; (6) work of the colleges in lines other than those of regular undergraduate instruction.

The interest of the colleges in the collection of data was promptly enlisted and this work is now practically complete. Committees of experts in education cooperated with the board in studying the several divisions of the field and their reports were presented at the convention. Professor Hammond called attention to a few of the outstanding facts already disclosed. For example, the quality of preparation of entering students is seriously unsatisfactory in the essential elements of training and mental discipline which should precede an engineering education. The principal deficiencies are in mathematics and English. In the fall of 1924, one student in eight was admitted with conditions in mathematics.

Another significant fact is that boys make their decisions as to their careers early in the high-school course, suggesting the need for closer co-operation between the colleges and the schools. At the same time, the colleges are devoting more attention to the orientation and motivation of students just after admission, in guidance in the selection of studies and in efforts to start students thinking from the standpoint of the engineer.

From the graduates it was learned that numerous changes in employment are made during the first few years after graduation. The graduates urge more or better training in the principles of economics and the knowledge of business procedure, while recognizing that the scientific and technical portions of the curricula are the real foundation of the training of the engineer. Graduates also place emphasis on the importance of English and cultural subjects, although the students early in their course think otherwise.

A disquieting feature of the returns is that elimination ratios in the technical schools are higher than in some other professional schools, largely through scholastic failure.

European Engineering Education—Director Wickenden has spent six months abroad and is returning at once for further study. An abstract of his impressions to date follow:

In Great Britain engineering is understood to be the product of experience, schooling being supplementary. Hence technical education is modestly developed in the universities, and is a rather new division of education.

This is compensated for by extraordinary development in part-time schools for employed men and the higher development of apprentice training in industry. The British have developed means of recognizing other forms of technical education by a system of national diplomas and certificates. These are granted by the Institution of Mechanical Engineers and Institution of Electrical Engineers in conjunction with the national board of education.

On the continent the facilities for giving professional training in industry are comparatively scant and the university type of professional education is much more popular.

In France the secondary schools are highly developed and there is an intensely competitive system for admission to the higher institutions. Thus French colleges are recruited from the élite, scholastically speaking, and they give a high theoretical emphasis to their training as contrasted with practical training. France appears to have no large-scale program for expanding technical education at the top, but is doing something to better the already good schools of middle grade and to develop apprentice systems for individual workers in the ranks.

TABLE SHOWING TENDENCY FOR STUDENTS IN PRUSSIA TO STUDY TECHNOLOGY

	Enrollment 1914	Enrollment 1924	Increase or Decrease Per Cent
University students, pursuing studies in law, medicine, dentistry, theology, economics, science, etc.	28,710	21,710	—25
Students in the technical high schools (subdivided as below)	4,910	9,870	+100
Total	33,620	31,580	— 6
Technical high schools, per cent of totals	15	31	
Subdivision of technical high school students			
Civil engineering	1,250	860	— 31
Mechanical and electrical engineering	1,700	5,790	+240
Chemical engineering	1,000	1,340	+ 34
Other engineering	960	1,880	+ 97
Total	4,910	9,870	+100

SOME GENERAL STATISTICS OUTSIDE OF PRUSSIA

	Technical Schools Enrollment 1914	Technical Schools Enrollment 1924
Darmstadt	1,200	3,000
Stuttgart	800	2,000
Dresden	1,500	3,300
Munich	2,400	5,000

In Belgium all forms of higher education have been literally saved from extinction by American generosity. This includes the application of the residue of the Hoover relief fund to education, the great gift to the University of Louvain to replace its library, the Solvay gift for the reconstruction and re-equipment of the University of Brussels, etc. In this country higher technical education is given in the universities in a 5-year program, the first two years being principally devoted to the general sciences, and the last three professional in character. The results are substantially equal to those secured in France, where admission is much more restricted and the program condensed into three years.

In Italy the technical schools are overcrowded and making great efforts to expand facilities to meet the demand. In Milan one of the most elaborate institutions in the world is under construction. In Italy there is a 5-year program as in Belgium. The theoretical training is good, but the laboratories lack staff and equipment.

Switzerland already has an admirably developed system of higher and intermediate education, and has attracted to the professorships engineering talent of high order.

In Switzerland, Central Europe and Holland the aim is to produce creative technical men, not administrators, commercial representatives, etc. There is a strong bias toward design. After two years of introductory general science, students work on an elaborate series of projects which in size and complexity approach practice as nearly as possible. The work is done on the students' own responsibility, with the counsel and advice of the professor and his assistants if this is desired. This work requires professors of the highest theoretical and practical training, and the professorships are filled by men who have had distinguished careers in engineering.

German Conditions—In all of these countries but Holland, and notably in Germany, there is going on a great expansion in higher technical education. The enrollment in Germany has more than doubled, as compared with the total enrollment. The increase is notable in electrical, mechanical and chemical engineering, which are closely tied up with industrial development.

The level of training in Germany and the other countries mentioned corresponds to the master's degree in this country, with a strong leaning to the more purely technical side of engineering. A greater number of able young engineers, proportionately, take the doctor's degree than in this country. Competition will come chiefly in the field of creative technical work.

Effect of New Immigration Law

More common laborers left the United States than were admitted during the first ten months since the new 2 per cent quota immigration law went into effect, according to an analysis of immigration statistics for that period made by the National Industrial Conference Board. Common laborers admitted from July, 1924, to April, 1925, were 27,908 in number, as against 97,886 during the same period a year previous; but 44,750 of that class left the country during the same time, leaving an actual deficit of 16,842 for the ten months since the operation of the new immigration law. Net immigration of all classes from July, 1924, when the new law became operative, to April, 1925, shows a decrease of 71.4 per cent as against the corresponding period the year before. A total of 242,965 persons were admitted during the ten months, under the new quota law, as against 637,602 during the same period the year previous, showing a decline of 62 per cent in total immigration. From July, 1924, to last April, 78,578 departed, as compared to 63,324 from July, 1923, to April, 1924, leaving a net immigration during the last ten months of 164,387, as against 574,278 during the corresponding ten months in the year prior to the new quota law. Of the 242,965 admitted during the ten months ending last April, 13,352 were farm laborers; of this class, only 1,232 left the country during the same period, leaving a net gain of 12,120 of farm laborers. Others admitted were: professional people, 8,809, while 1,665 emigrated; skilled labor, 41,716, of which class 7,171 left; of miscellaneous occupations, 40,204 were admitted, 6,367 of this class leaving; of no occupation, including women and children, 98,927 came in, and 17,262 departed.

Two Parkway Bridges Planned by Engineer and Architect

Bridge Over Pond Built of Single-Stem Mushroom Units—Rigid-Frame Girder Bridge of Unusual Outline Harmonizes with Architecture of Nearby Dam

By Arthur G. Hayden

Designing Engineer,
Bronx Parkway Commission,
Bronxville, N. Y.

FIG. 1—SCARSDALE BRIDGE CARRYING BRONX PARKWAY OVER LAKE

TWO noteworthy short-span bridges are being built on the Bronx Parkway, which extends from Bronx Park, New York City, to Valhalla, Westchester County, N. Y. These two bridges are novel structures both architecturally and structurally and meet certain difficult conditions of locality in a most satisfactory manner. The two bridges are considered together in this article because the first (Bridge 28, at Scarsdale) was primarily the conception of the architect, and the designing problems were solutions of the general idea; the second (Bridge 50, at Valhalla) was primarily the conception of the structural engineer, and the success of the idea from an aesthetic point of view was due to the genius of the architect. Both structures are good examples of the results of co-operation between engineer and architect, the inception being different in the two cases.

The policy of the Bronx Parkway Commission to co-ordinate the work of engineer and architect in the design of the Parkway structures has resulted in a series of beautiful bridges that has attracted the attention of architects and engineers from all sections who have visited and inspected this great piece of work.

The best results cannot be obtained by the architect or engineer alone. Structural requirements must be met and the rules of beauty must be observed as well in order to obtain satisfactory results, and unfortunately scientific minds and artistic minds are rarely combined. Even though this tempermental differentiation did not exist it would seem hopeless to try to develop the architect-engineer or engineer-architect. The development of engineering mechanics and mathematics has been so rapid in the past twenty years that even the practicing engineer is hard pressed to keep pace with the engineer mathematician. The architect on the other hand has centuries of artistic development to study and digest beside being faced with the problem of adjustment to new structural developments. Either task is formidable in itself. Specialization is a compelling force, and co-ordination is increasingly urgent.

Scarsdale Bridge—The Parkway Drive crosses from the west side of the Bronx River to the east side at Scarsdale, and general conditions restricted the crossing to a point where the little river widens to form a small lake in a setting of natural beauty. The picturesqueness of this location could be preserved or destroyed by the type of structure selected, which would total a length of about 600 ft. The drive crosses the lake and then the tracks of the New York Central R.R., both crossings being on a heavy skew so as to provide safe approaches. The engineers first considered an arch span over the lake having a skew of about 45 deg. and prepared perspective sketches. A closed-spandrel arch would have presented to view from either side of the lake a wide expanse of the concrete soffit, because of the heavy skew, and would have been an awkward looking structure. An open-spandrel arch of several ribs would have given a lighter appearance, but would have required greater height and necessitated raising the proposed grade of the drive over the lake. This would have resulted in a very steep south approach in order to be

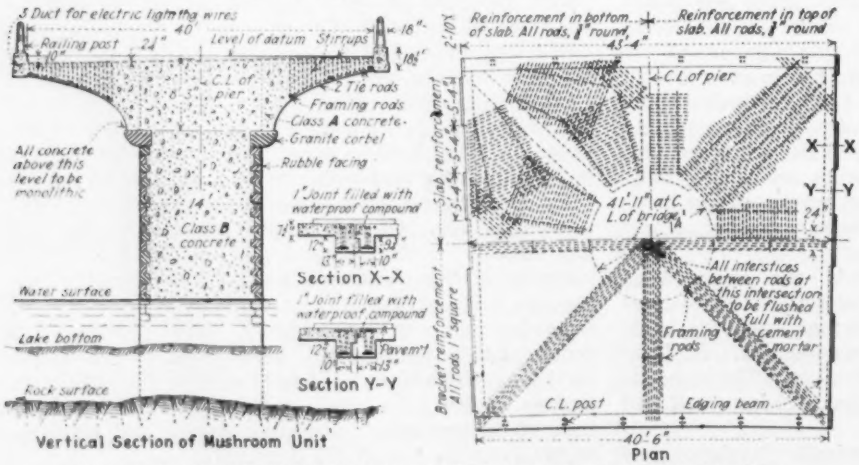
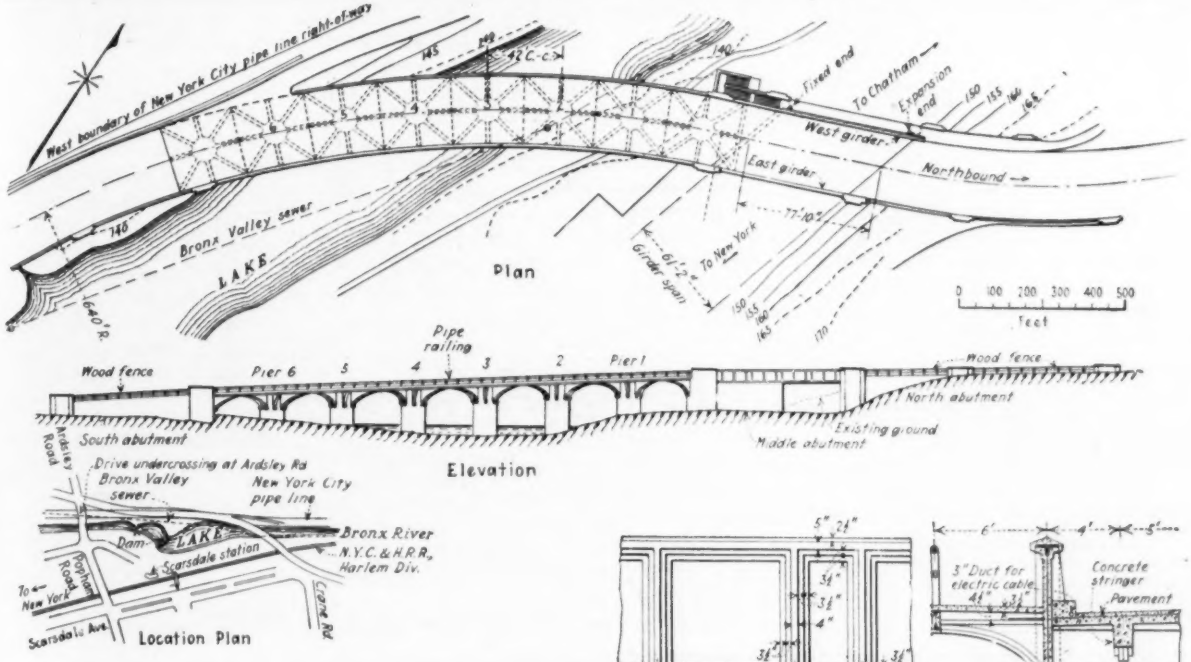


FIG. 2—PLAN AND SECTION OF MUSHROOM UNIT, SCARSDALE BRIDGE



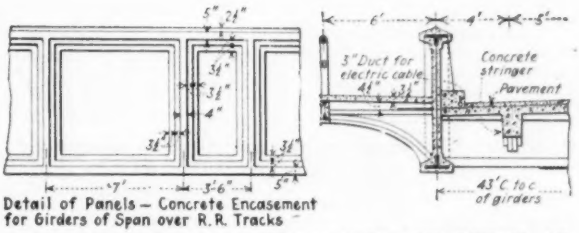

Detail of Panels – Concrete Encasement for Girders of Span over R.R. Tracks
3" Duct for electric cable
Concrete stringer
Pavement
43'C. to c. of girders

FIG. 3—PLAN OF SCARSDALE BRIDGE AND DETAIL OF CONCRETE-CASED GIRDER OVER TRACKS

able to carry the drive under Ardsley Road, a few hundred feet south of the bridge.

Chief Engineer Jay Downer called upon W. A. Delano (of Delano & Aldrich, architects, of New York City) to give his advice on the problem and a happy solution was reached. Eight mushroom units totaling 336 ft. were designed to carry the drive over the lake, and a plate-girder span with girders encased in paneled concrete was designed to carry the drive over the railroad tracks. A bracketed masonry-faced pier 14 ft. in diameter supporting a reinforced-concrete floor slab constituted each mushroom unit. True mushroom units without brackets or side beams could have been designed, but the architectural appearance would have been bare. The brackets and fascias were therefore used as structural members and, for symmetry of design, edging beams were added where the units joined. The edging beams were dovetailed to prevent unequal deflection of adjacent slabs under unequal loading. The structural details of the units are sufficiently indicated on the sketches. All architectural details were prepared by Delano & Aldrich. The structural design was prepared in the designing department of the Bronx Parkway Commission under direction of the writer. The Triest Contracting Corp. of New York City is the contractor.

Valhalla Bridge—Bridge 50 will carry the Parkway Drive over the New York Central R.R. tracks about half a mile south of Valhalla station. A plate-girder span with girders encased in paneled concrete as adopted for the railroad crossing at Scarsdale would have been a simple solution, but such a structure, visible from the driveway both north and south, would have been dwarfed by the massive construction of the beautiful Kensico Reservoir dam nearby. The entire development in this neighborhood will be formal and impressive. The writer considered the problem of this structure in relation to the whole, and devised a design for fixed-end concrete girders of variable depth, integral with the rest of the structure. The problem of temperature expansion was troublesome and the first design was modified. Rigid-frame girders of variable section, integral with the U-abutments retaining the approach fill, and supporting a beam-and-slab floor system, were then analyzed and found to compare favorably with the first design, though the cost was somewhat greater. The approach retaining walls are here

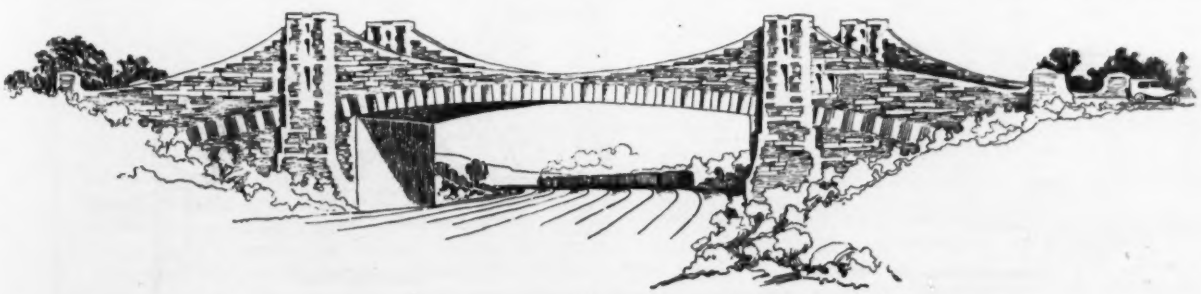


FIG. 4—VALHALLA BRIDGE, DESIGNED WITH REGARD TO VICINITY OF KENSICO DAM

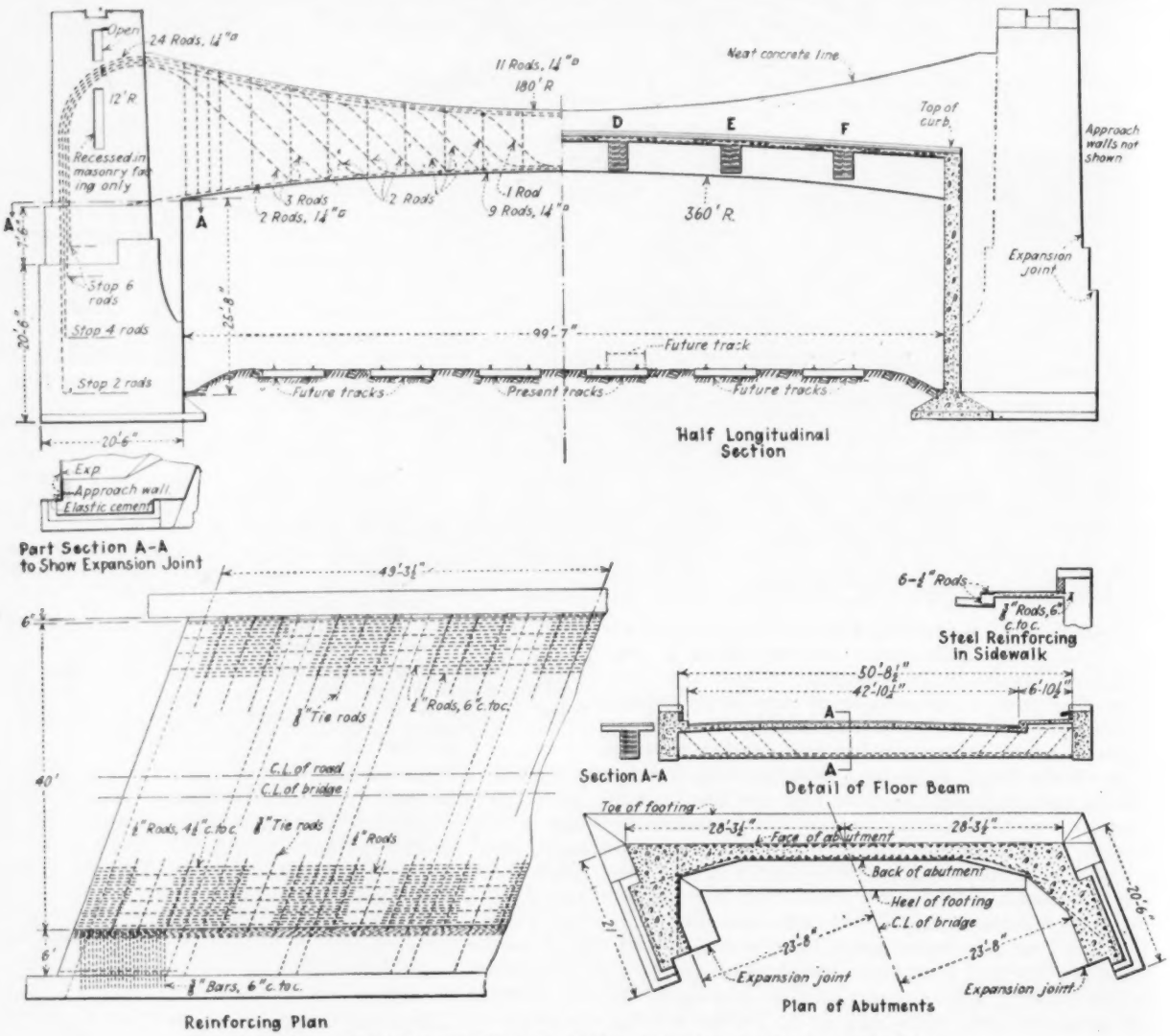
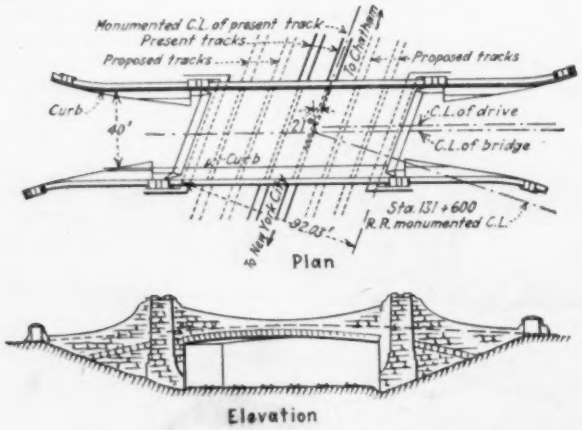


FIG. 5—FRAME GIRDERS AND FLOOR SLAB OF VALHALLA BRIDGE

independent of the main structure and expansion joints are provided between the approach walls and main structure. The outward appearance of both designs would be alike.



The controlling lines were determined by the writer, but were susceptible of variation to suit the taste of the architect. It is possible in the design of statically indeterminate structures of this class to control the bending moment to be resisted at any particular point of the girder, by varying the properties of other portions. Any general shape may be selected and definite proportions determined by the rules of internal work. In this way the maximum freedom may be given to the architect.

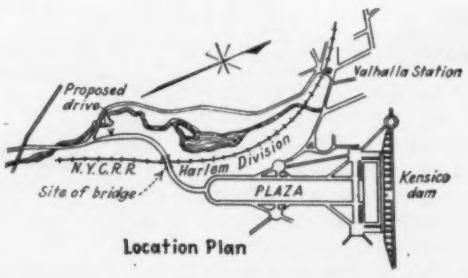


FIG. 6—VALHALLA BRIDGE, AND ITS RELATION TO KENSICO DAM

The architectural problems were referred to Charles W. Stoughton. Mr. Stoughton has been unusually closely identified with the architectural development of the parkway structures, and most of the many beautiful bridges along the parkway are his creations. This bridge is under construction but the appearance can be judged from the architect's drawing.

As seen by the illustration the bridge is a reinforced-concrete structure with brick and stone mosaic facing. It has a total width of about 50 ft. and a clear span of about 100 ft., so as to cross six tracks, present and future, at a skew of 21 deg. The design involved complicated mathematical analysis and one would expect the designing cost to be high; but complete design, contract drawings, estimates and specifications were made at a percentage cost of one per cent, which testifies to the efficiency of the commission's designing force. This is a fair example of the work of the department.

The same structural ideas could be adopted for a plainer bridge with great economy because every part of the structure, including the U-abutments, is made to do work and assist the main girders in the performance of their functions. The buttresses are architectural additions.

The designing department of the New York Central R.R., under direction of H. T. Welty, engineer of structures, reviewed the design of the bridge for that company. The Phillipsburg Construction Co. of Yonkers is contractor. Construction is under direct supervision of W. F. Welsch, field engineer for the parkway, who is also in charge of the work on the Scarsdale bridge.

Both bridges described in this article will ordinarily carry pleasure traffic only, but for purposes of design and to provide against traffic congestion, the following loads were assumed: concentrations, 12-ton road roller with 25 per cent added impact allowance; uniform load, 100 lb. per sq.ft. on roadway and 75 lb. on sidewalks. Concentrated loads and uniform loads were combined. Allowable unit stresses were 800 lb. per sq.in. in concrete and 18,000 in steel. Modern methods of designing concrete mixtures are in force and 3,000-lb. concrete at 28 days is the standard set for the product. The instructions issued to the field forces for designing concrete have been published in pamphlet form by the Portland Cement Association.

The officers of the commission which has developed the parkway are: Madison Grant, William H. Niles and Frank Bethell, commissioners; Jay Downer, engineer and secretary; Leslie G. Holleran, deputy chief engineer.

Estimated State and Local Highway Expenditure Program for 1925

Prepared by the U. S. Bureau of Public Roads, Washington, D. C.

States	By or Under Supervision of State Highway Department: Construction — Probable Expenditure	Construction — Total Miles*	Maintenance — Probable Expenditure	Maintenance — Total Miles	Total Probable Expenditure	Probable Local Road and Bridge Expenditure	Grand Total Expenditure State and Local	Road Mileage by Types To Be Constructed Under Supervision of State Highway Dept.: Earth Improved	Sand-Clay Gravel and Macadam	Asphalt, Concrete, and Brick
Alabama	$7,000,000	460	$360,000	1,300	$7,360,000†	$7,296,000	$14,656,000	.....	385	75
Arizona	2,600,000	115	700,000	1,607	3,300,000	500,000	3,800,000	.....	75	40
Arkansas	10,000,000	1,775	2,000,000	5,000	12,000,000	7,000,000	19,000,000	1,200	500	75†
California	6,600,000	190	5,200,000	4,900	11,800,000	25,000,000	36,800,000	.....	100†	90†
Colorado	2,850,000	133	1,300,000	8,674	4,150,000	1,000,000	5,150,000	.....	100	33
Connecticut	6,700,000	170†	3,500,000	1,825†	10,200,000	2,000,000	12,200,000	.....	90†	80†
Delaware	2,100,000	55	107,000	441	2,207,000	1,680,000†	3,887,000	.....	.....	55
Florida	7,211,300	400	552,400	1,275	7,763,700	15,500,000	23,263,700	160†	200†	40†
Georgia	4,785,000	419	1,865,000	6,000	6,650,000†	11,100,000	17,750,000	41	340	38
Idaho	1,650,000	120	550,000	1,890	2,200,000	1,000,000	3,200,000	10	85	25
Illinois	51,000,000	1,800	1,175,000	4,700	52,175,000	20,000,000	72,175,000	300	.....	1,500
Indiana	10,744,000	382	3,000,000	3,950	13,744,000	32,096,000	45,840,000	.....	157	225
Iowa	6,180,000	554	3,204,000	6,660	9,384,000	30,000,000	39,384,000	370	106	78
Kansas	3,375,000	250	250,000	1,100	3,625,000	9,458,500	13,083,500	90	95	65
Kentucky	6,786,000	358	2,000,000	2,100	8,786,000†	10,400,000	19,186,000	166	145	47
Louisiana	6,500,000	500	1,500,000	3,500	8,000,000	7,000,000	15,000,000	.....	470	30
Maine	3,380,000	348	1,500,000	4,900	4,880,000	3,800,000	8,680,000	.....	346	2
Maryland	3,300,000	140	3,297,200	2,350	6,597,200	3,005,000†	9,602,200	.....	55	85
Massachusetts	10,315,000	256	3,111,000	1,522	13,426,000	8,000,000	21,426,000	.....	188	68
Michigan	20,000,000	650	5,500,000	6,600	25,500,000	28,000,000	53,500,000	.....	305	345
Minnesota	11,000,000	2,850	7,000,000	20,000	18,000,000	6,000,000	24,000,000	1,200	1,500	150
Mississippi	2,500,000	200	750,000	2,000†	3,250,000	11,300,000	14,550,000	100	80	20
Missouri	25,000,000	1,480	2,000,000	7,420	27,000,000	12,000,000	39,000,000	420	500	560
Montana	1,600,000	225	175,000	1,000	1,775,000	2,000,000	3,775,000	.....	225	.....
Nebraska	3,500,000	625	1,750,000	5,700	5,250,000	5,000,000	10,250,000	200	400	25
Nevada	1,500,000	130	255,000	1,100	1,755,000	500,000	2,255,000	24	101	5
New Hampshire	2,000,000	70	1,500,000	1,000	3,500,000	1,500,000	5,000,000	2	65	3
New Jersey	13,525,000	192	5,700,000	3,900	19,225,000	5,200,000	24,425,000	.....	110	82
New Mexico	1,500,000	186	650,000	4,000	2,150,000	200,000	2,350,000	60	120	6
New York	22,000,000	430	18,000,000	9,500	40,000,000	24,000,000	64,000,000	.....	50	350
North Carolina	13,000,000	650	3,500,000	6,000	16,500,000	5,000,000	21,500,000	.....	400	250
North Dakota	2,400,000	701	300,000	1,500†	2,700,000	2,000,000	4,700,000	460	240	1
Ohio	21,000,000	800	8,000,000	5,630	29,000,000	50,000,000†	79,000,000	.....	475	325
Oklahoma	8,000,000	400	1,000,000	5,000	9,000,000	11,000,000	20,000,000	70	225	105
Oregon	4,200,000	410	1,800,000	3,200	6,000,000	5,000,000	11,000,000	200	200	10
Pennsylvania	32,000,000†	900†	21,000,000†	12,300	53,000,000†	20,000,000†	73,000,000†	20†	410†	470†
Rhode Island	2,300,000	40	700,000	406	3,000,000	850,000	3,850,000	.....	16	24
South Carolina	3,500,000	263	1,600,000	3,200†	5,100,000	5,000,000	10,100,000	200	.....	63
South Dakota	4,177,900	550	650,000	4,400	4,827,000	5,500,000	10,327,000	100	450	.....
Tennessee	8,700,000	624	2,000,000	4,644	10,700,000	10,500,000†	21,200,000	338	188	98
Texas	12,000,000	1,180	5,000,000	16,000	17,000,000	24,000,000	41,000,000	110	890	100
Utah	2,483,000	201	450,000	3,000	2,933,000	550,000	3,483,000	.....	199	2
Vermont	1,637,000	140	1,000,000	4,200	2,637,000	750,000	3,387,000	.....	130	10
Virginia	6,240,000	189	2,138,500	4,600	8,378,500	7,000,000	15,378,500	22	125	42
Washington	8,000,000	400	1,500,000	2,800	9,500,000	10,000,000†	19,500,000	200	140	60
West Virginia	10,000,000	600	2,000,000	1,500	12,000,000	7,000,000	19,000,000	400†	150†	50†
Wisconsin	5,737,000	475	3,062,000	10,000	8,799,000	7,309,000	16,108,000	100	250	125
Wyoming	2,292,000	450	611,000	3,500	2,903,000	500,000	3,403,000	200	250	.....
Totals	$404,867,300	24,326	$134,763,100	217,794	$539,630,400	$463,494,500	$1,003,124,900	6,763	11,631	5,932

* Details given in last three columns. † Estimate based on data of previous years.

Points in the Design and Construction of Pipe Sewers

Improved Methods Urged to Meet Changing Conditions—Examples of Canadian and Washington Practice and Suggested Modifications

By A. G. Dalzell
Consulting Engineer, Toronto, Ont.

Mr. Dalzell's article is based on experience gained as assistant city engineer in charge of sewer construction at Vancouver, B. C., during which 145 miles of sewers were built, mostly by day labor, and on six years of observation of sewer work in most of the cities and towns of Canada.—Editor.

CONSTRUCTION of sewerage and drainage systems with burnt clay tile pipe of the bell-and-spigot pattern has been carried on for nearly a century with very little change in methods. The difficulty of making a satisfactory joint with this class of pipe has long been recognized, and many attempts have been made to secure truer alignment and better joints by a modification of the shape of either bell or spigot end. None of these special features has ever been extensively adopted, and the ordinary plain pattern remains standard construction throughout the world. It is significant that the modern concrete pipe, though made by processes quite distinct from those used in the making of clay tile, is yet usually made of the same shape as the clay pipe.

In the use of jointing material there has been the same conservative tendency. In the early systems, well tempered clay was used to fill the annular space of the joint; lime mortar was also used, to be superseded by

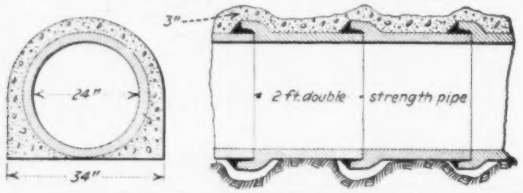


FIG. 1—STANDARD FORM OF SEWER PIPE CONSTRUCTION IN A LARGE CANADIAN CITY
Entire pipe surrounded with concrete down to level of lower part of ring.

cement mortar which is now almost universal, though some bituminous jointing materials are on the market and are occasionally specified. In making the joint with cement mortar some engineers insist on the use of oakum or jute packing, and others are equally insistent on prohibiting its use. But with or without packing, all recognize the possibility of the spigot end dropping in the bell, and the difficulty of securing a thoroughly tight and effective joint in the bottom of the pipe, just where it is most essential.

Improved Methods Needed—The majority of engineers appear to take little interest in ordinary sewer pipe construction, and because the work is difficult to supervise during construction, and out of sight when completed, careless and indifferent work is too often tolerated. With the demand for pavements and hard-surfaced roads most large towns are confronted with the problems of sewer construction, or reconstruction. In some cases the work is well done, because the engineers in charge of the work are also in charge of sewer maintenance and appreciate the value of sound construction. But adjacent to all large towns, in small communities and in much highway work, sewer and drain construction is being carried out by engineers who have had little experience with sewer maintenance, and consequently they fail to appreciate the importance of the small detail of construction on which the efficiency and permanence of the work depend.

Immense strides have been made in the art of road-making and pavement construction, but the standard of construction of the ordinary pipe sewer has not improved but has rather deteriorated. Labor conditions partly account for this because the difficulty of securing suitable labor has led to a greatly extended use of

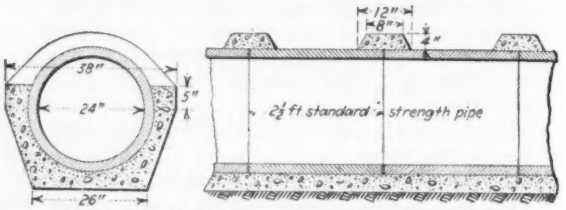


FIG. 2—STANDARD PIPE CONSTRUCTION, WASHINGTON, D. C.
Concrete under lower two-thirds, with concrete bands over upper third at joints only.

mechanical excavating and backfilling machines. Whilst these expedite the work and reduce the cost of construction they do not tend to improve the pipe laying, or help to secure the stability and permanence of the sewer. Some reasons for this statement are: With mechanical excavation there is always the tendency to make the excavation wider than necessary, and in consequence the pipes are deprived of the lateral support which is necessary to assist them to carry the load of the backfill, or to prevent lateral displacement. (See "Relation of Sewer Trench Width to Load on Pipe," by G. C. D. Lenth, *Engineering News-Record*, March 27, 1924, p. 533). With mechanical excavation hand work is avoided and the bottom of the trench is seldom properly prepared for the pipe to bed solidly. Timbering is dispensed with as much as possible, and so backfilling has to follow quickly, often before the joints have properly set. With backfilling machines there is always a tendency to drop large quantities of backfill from a height, and a shock is imposed on the pipe which often breaks the joint and cracks the pipe.

A thorough inspection after construction of a small size pipe sewer is almost impossible. Few engineers care to go through 24- to 36-in. pipe sewers. If they did go they would be astonished at the number of defective joints and in many cases cracked pipe. It usually takes some time for these defects to be revealed, though long before they are discovered they may be responsible for damage to pavements, undermining of foundations, increased costs of sewage pumping, or the pollution of underground water supplies. Municipal engineers who have had to undertake any large amount of sewer reconstruction, and have seen these defects, have often adopted the practice in all new work of covering all pipes above 12 in. in diameter with concrete. It has however been too generally assumed that the failure of the pipe was due to inherent weakness in the pipe structure itself, and the concrete is therefore placed in the form of an arch over the pipe. But most frequently the failure of the pipe occurs because of the lack of proper support underneath, and

this lack of support often arises through leakage from the bottom of the joint of the pipe, which washes away the foundation. In such cases the arch is of little value, and in any event it is contended that the concrete is far better placed to secure the most efficient and economical results by putting it below the pipe instead of over it.

Canadian Practice—Fig. 1 shows how pipe sewers over 12 in. in diameter have to be covered with concrete according to the specifications of the public works department of a large city in Canada. The thickness of the concrete casing is specified as 3 in. and is the same for all diameters of pipe, and this thickness is supposed to be maintained over the bell as well. According to this specification the amount of concrete used per linear foot of pipe of various sizes is: 15-in., 1.25 cu.ft. per lin-ft.; 18-in., 1.35; 21-in., 1.9; 24-in. 2.18; 27-in., 2.5; 30-in., 2.9.

It is obvious that this concrete casing has to be put on after the joints have been made in the ordinary manner. It does not therefore aid in any way the aligning of the pipe or the making of the joint, though it does help to preserve the alignment and partially protect the joint after it is made. But if the pipe is bedded solidly on the ground, as shown, bell holes must be

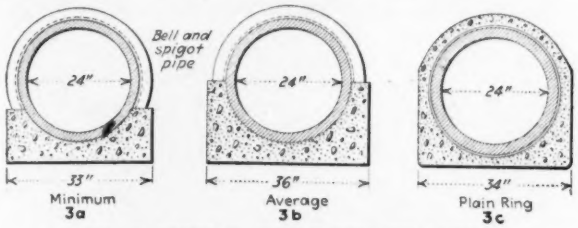


FIG. 3—METHOD SUGGESTED BY AUTHOR
Concrete beneath lower third of pipe as minimum and lower half as average for bell-and-spigot pipe; plain ring pipe to be surrounded with concrete.

dug and with the bell of a pipe in a hole the making of a good joint in the bottom of the pipe is difficult, and in wet ground cannot be properly done. Observation has shown that tree roots enter pipe sewers, almost invariably at the bottom of the joint. The reason is obvious: the joint is always weakest there, it is always damp and the bell hole itself forms a natural reservoir of damp earth which attracts the root. In wet or hard ground the digging of bell holes under present conditions of construction is a waste of money. Far better results can be secured at no greater cost, and better joints and a sounder bearing obtained, by bedding the pipes in coarse concrete.

Washington Practice—Fig. 2 illustrates the method of construction of pipe sewers adopted by the city of Washington, D. C. (Copied from Standard Drawing of Sections of Pipe Sewers issued by the Sewer Department of the city of Washington, July, 1919; signed Asa. E. Phillips.) This shows how with the same amount of concrete far better results can be got by placing the concrete beneath the pipe instead of over it. Indeed the soundness of this form of construction is so well established that it has been found possible to dispense entirely with the bell of the pipe, plain ring pipes being used with a concrete band over the upper part of the joint. With this form of construction it is said that the difficulty of tree roots entering the pipes has been overcome, though as is well known Washington has very extensive tree-planted boulevards. Though the writer has no personal experience of the construction of sanitary sewers with plain ring clay pipe, he is of the opinion that very distinct saving and many other advantages can be secured by this form of construction.

Suggested Modifications—Plain ring pipe can be more easily manufactured than bell-and-spigot pipe; the saving in weight is considerable; the loss in manufacture, handling and transportation would be reduced; freight would be saved; and where excavation has to be done by hand the saving in trench width alone would in deep trenches be sufficient to pay for the concrete casing. If the joints were first wrapped with a bituminous bandage, watertightness would be effectively secured and the concrete protected against any deleterious action of the sewage.

Fig. 3 *a* presents the suggestion of the writer for the construction of pipe sewers with the ordinary pattern of bell-and-spigot pipe, where the ground conditions are good. The lower third of the pipe is bedded in concrete and the whole of the unprotected part of the joint can be easily made and readily inspected. Fig. 3 *b* may be used where the ground conditions are not so good, or where the load of backfill is excessive or the pipe so near the surface that it may receive shock from live-loads. Fig. 3*c* shows plain ring pipe completely encased in concrete, the joints being first wrapped with bituminous bandage.

It will be noted that these sections differ slightly from the standards of the city of Washington, being designed to fit square-cut trenches as left by excavating machines. It is believed that under present conditions the extra cost of the concrete is offset by the saving of hand labor in shaping the ditches to special sections, and this is often quite impracticable in loose or wet soils. It is also believed that in the majority of cases it will be found cheaper to encase a plain ring completely in concrete rather than try to save concrete but lose time by having to place forms or templets to confine the concrete in narrow bands over the joints.

Whether sewers are constructed of plain ring pipe or pipe of the ordinary pattern much greater attention should be paid to the bedding and jointing of the pipe if permanent and efficient sewers are to be secured, whether they are constructed of clay or concrete pipe. The reconstruction of sewers under paved roads is seldom less than double the cost of the original construction and the damage done by a defective sewer is seldom confined to the width of the sewer trench.

To secure the true alignment and proper jointing of pipe sewers the writer contends that it is necessary: (1) To have some appliance to securely hold the pipes in correct position and true invert alignment whilst the joints are made; (2) to fill the joint with the maximum of jointing material and the minimum of jute or other packing; (3) to bed the pipes in concrete to at least the lower third of the circumference; (4) to point off the upper part of the joint carefully and protect it and the pipes by backfilling with hand labor, with a suitable damp material, before backfilling by machinery.

There is one other point that needs to be remembered. The most perfect sewer system can be ruined and all the well laid plans and careful construction of the engineer be defeated unless the proper control and construction of all service connections is secured, so that the same standards of construction can be maintained, at least on all public property.

Multiple Arch Dam Disintegrates Under Low Temperatures

California Dam Rebuilt to Gravity Section When Water Freezes in Concrete Due to Cold Penetrating Thin Slabs

A MULTIPLE arch dam on Gem Lake in California was last year rebuilt to a gravity section after progressive disintegration of the concrete due to freezing had been observed for several years and complete destruction of the arches was feared. Thickening the section, it is believed, will entirely stop freezing below the level of ice on the reservoir surface and no further disintegration of the concrete is expected. The dam, which was built eight years ago *(Engineering News*, Dec. 21, 1916, p. 1157), is operated by the Southern Sierras Power Co. and is at El. 9050 where temperatures as low as 25 deg. below zero sometimes occur.

The multiple arch type of dam was selected for this location because the foundation conditions were excellent and because the remote location and the consequent high cost of delivering materials would have made a gravity-section dam much more expensive. Bearing on this point it may be said that cement, in order to reach the dam, had to travel 451 miles by rail and then some 75 miles by motor truck, incline tramway and barge, necessitating a total of five rehandlings and making the cement cost $7.50 per barrel at the dam (1915 prices).

The dam includes sixteen 40-ft. arches with two fractional arches at the ends, making a total crest length of 688 ft. The maximum height of arch is 84 ft. and the height from crest to deepest point in the foundation is 112 ft. The thickness of the arches ranges from 3.95 ft. at the lowest point to 1.0 ft. at the crest. Buttresses have a thickness of 1.85 ft. at the top and 4.25 ft. at the deepest point. The upstream face of the dam makes an angle of 50 deg. with the horizontal. For these dimensions, the stresses figure within the limits prescribed by conservative practice and in fact the factor of safety in this structure considerably exceeds that used in other dams of similar type.

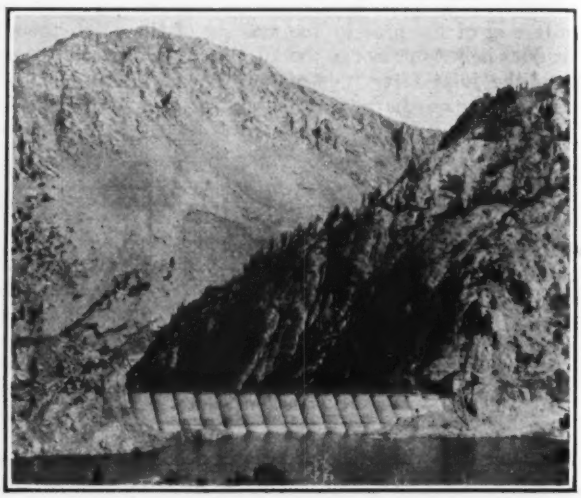
Further evidence of the stability and safety of the structure as a whole is found in the fact that in its eight years of operation no cracks of importance have occurred, and although not designed for overpour it once withstood a flood that overtopped flashboards on the dam for a period of eight hours.

When the dam was being constructed the upstream faces of the arches were covered with a 1:2 cement mortar put on with a cement gun to a thickness of ¼ in. at the top and ¾ in. at the bottom. The first two years after the reservoir was filled the leakage was almost negligible; thereafter, however, the leakage began to increase and a white deposit appeared on the downstream faces of the arches.

In the third and fourth winters after the reservoir was first filled disintegration of the concrete on the face of the dam was noticed and was then ascribed to frost action. This became more serious the following winter and a more extensive examination was made. Not only was serious disintegration of the concrete found at or near water level in the reservoir, but holes made through the ice, which was at the time 30 or 40 in. thick, showed that the upstream face of the dam was covered with a thin layer of ice for 8 or 10 ft. below water level. The primary cause of the disintegration was then ascribed to the fact that temperatures in the thin concrete slabs were low enough to cause the formation of ice on the upstream face which each season destroyed a new layer of concrete.

Following this discovery, the first attempt at repair was to put a surfacing on the upstream face of the dam that would be impervious to water; the theory being that if the concrete could be made absolutely watertight disintegration would not result from low temperatures. In preparation for this repair the entire surface of the dam was examined carefully and wherever cracking and disintegration had occurred, which was all below the winter water level, air driven chisels were used to remove all damaged concrete. This was a rather costly operation because concrete had to be taken off for depths as much as 8 in. and over considerable areas.

The concrete taken out was carefully replaced with new concrete, all ends and corners having been first chipped out square in an endeavor to preserve arch action. Care was taken also to secure a tight bond between old and new concrete and the new surface was given a treatment with "ironite."

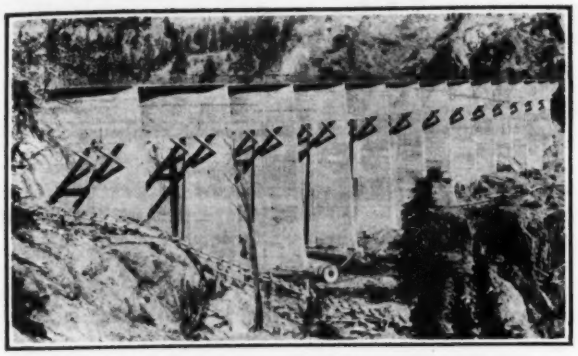


GENERAL VIEW OF GEM LAKE DAM

After this treatment the dam was watertight for a short time, but the first low temperatures caused hairline cracks to develop in the new facing and thereafter the disintegration of the surface began again in the same way as before.

Subsequent to the history outlined above and early in the low-water season of 1924, another examination of the structure showed that for about 30 ft. down from the top the concrete was still in excellent condition and likewise there was a section at the bottom of each arch which showed no deterioration. The zone in between these two areas, however, which varied in width up to a maximum of 40 ft. where the dam reached its greatest height, was not only disintegrating on the face but had lost its strength entirely through the arch.

The thickness of concrete in the damaged zone ranged from 1 ft. 10 in. to 3 ft. 3 in. At various points in this zone and in different arches exploration holes were dug into the concrete from the downstream face; these holes were made as deep as 18 in. in some cases, which was as much as was considered safe, since the holes were below water level in the reservoir. The material removed was



BUTTRESSES ON DOWNSTREAM SIDE OF DAM
Note counterforts on sides of buttresses which were of great value in locking new gravity section into old structure.

not good concrete, it was taken out easily in chunks with a pick and is described as being of about the same consistency as hard clay. Not much leakage came through these holes at low reservoir level, but it is believed that with higher levels considerable leakage would have resulted.

The reason for the disintegration being confined to the central zone is ascribed to the fact that by the time the extremely low winter temperatures occur the water level in the reservoir has been drawn some 30 ft. or more below the crest of the dam and by that time snow banks have drifted up against the downstream sides of the arches. The top of the damaged zone is level, corresponding with winter water level, and the bottom varies with the depth of the arches, usually extending to within about 10 ft. of the lower end of the arch barrel.

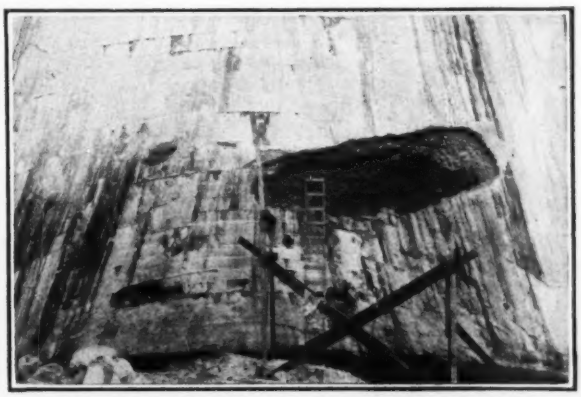
Tests made recently on two samples taken from the concrete in the upper 30 ft. of the structure showed them to have strengths, in compression, of 1,880 and 2,170 lb. per sq.in. respectively. The concrete in this upper portion of the dam, of course, was made in the same way and with the same materials as that in the middle zone; the mix proportion was 1:2:4. The aggregate was made up of crushed rock, graded into three sizes from a screen having ¼, ¾ and 1½-in. meshes. Analyses of the sand which was taken from the lake showed it to contain 3½ per cent of clay and 1 per cent of dirt. This was mixed with the sand from the rock crusher (particles less than ¼ in. in diameter) in the proportion of 75 per cent lake sand to 25 per cent crushed-rock sand—a combination shown by tests made at the time of construction to give a concrete which was satisfactory in every way. These classifications of materials are taken from a paper in *Proceedings*, Am. Soc. C.E. (p. 85, Vol. 81, 1917) by Lars Jorgensen, designer of the dam. Chemical analyses of aggregate and cement used are not given.

After discovering that the concrete had in large measure lost its strength entirely through the arches in the damaged zone, it was realized that some method of repair more effective than treating the upstream surface was necessary. The plan of placing a rock fill behind the multiple arch dam was rejected on account of the time required to do this work, but more particularly because it was felt that any rock fill would probably settle away from the arches enough to leave them unsupported.

The method finally adopted was to pour a concrete gravity section behind the arches, extending this up to within 30 ft. of the top of the structure. This plan had the advantage that it could be done in a single season without the loss of any water and would give a structure with a section not only heavier than the standard for dams of this height, but due to the added pressure of the water stored in the 30 ft. above this gravity section the resultant fell well within the middle third of the base and maximum pressures at the downstream toe were kept below 5 tons per sq.ft. Stresses in the upper 30 ft. of the dam are expected to be transmitted direct to the buttresses and not to the newly placed gravity section. A horizontal crack in the arches opposite the top of the gravity section is not unexpected but will not be serious, it is thought, as the two structures are expected to act independently.

Drains were placed at the upstream toe of the gravity sections in the shape of precast porous blocks, 12 in. square with a 4-in. core. Similar drains were also placed along the spring lines of the arches leading to drain tiles under the gravity section.

The placing of the gravity section in the Gem Lake dam was carried out by Dwight P. Robinson & Co., Inc., for whom E. C. Macy was resident engineer. The work was under the general direction of Fred O. Dolson, vice-president and assistant general manager, and in immediate charge of E. J. Waugh, construction engineer, Southern Sierras Power Co. C. O. Poole and Walter L. Huber were consulting engineers.



EXPLORATION HOLE IN LOWER SIDE OF ARCH
The reinforcing showing is about a foot inside the downstream face at this point.

Few New Ideas in English Government Industries

The stultifying effect of government ownership on progression in industry is commented on as follows in an editorial in London *Engineering:* "In government or municipal services salaries have a certain resemblance to the laws of the Medes and Persians in that they alter not. It is in fact commonly the appointment that is paid and not the individual. This precludes any adequate recognition of special ability, and it is thus unreasonable to claim the vesting in the department or in the municipality of patents taken out by employees not especially engaged in specific research work. In the past, the post office regulations have distinctly discouraged ingenuity on the part of their technical staff. Until the telegraphs were taken over by the government, three-fourths of the improvements in the art originated here. Subsequently, practically every new idea was imported, although in submarine telegraphy, which still remains under private control, we continued to play a leading part in the advancement of the art."

From Job and Office

Hints That Cut Cost and Time For the Contractor and the Engineer

Electric Passenger Cable Suspension Line

By Dr. Robert Henker
Vienna, Austria

THE latest ideas in cable-track construction are embodied in the recently-erected passenger line at Oberiensenthal, Austria. Also, newest safety devices have been installed, making serious accidents almost impossible.

The track is 1,145 m. long and rises 305 m., giving it an incline of 28 deg. It has five supporting towers and the greatest span is 526 m. It operates on the pendulum system, that is there are two cars and two tracks. One

ELECTRIC CABLE CAR ON 28-DEG. INCLINE

car travels upwards while the other is coming down, which itself is a considerable safety factor. The tracks consist of two sets of supporting cables and two sets of traction cables. The width between the supporting cables is 50 cm. They are anchored in concrete blocks on the mountain station, and held taut by weights in the valley station. The traction cables which run simultaneously pass over leather-covered pulley wheels, which have a tension equalizing arrangement, insuring the even unrolling of the cables. Power is supplied by an electric motor, with a reserve gasoline engine.

The cars look like small street cars with large plate-glass windows. Each car has eight wheels with deep grooves so that derailment is hardly possible, even when the cables are coated with ice. Iron arms on the cars further guard against derailment. The weight of the car being distributed on eight wheels insures an even pressure on the cable and causes a minimum of wear. The running speed is 2 m. per second.

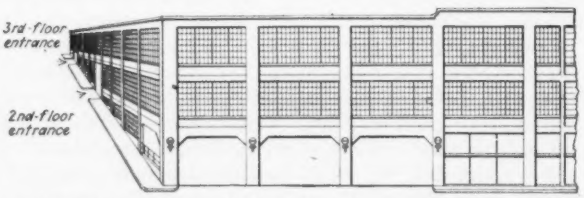
Further automatic safety devices regulate the speed of cars. The initial and final speeds are controlled by the engineer at the power station with brakes. Nevertheless, so as to be entirely independent of the human element there are automatic slowdown and stop arrangements. If the normal speed is exceeded by 10 per cent a speed regulator goes into action, and a warning bell is rung in the engine room, and keeps ringing until the speed is reduced to normal. If the speed is 20 per cent over normal, the entire plant stops automatically. In case of a break in one of the traction cables the cars also stop automatically, and the trip is then supposed to be completed very carefully using the remaining traction cable. The brakes are equipped with an automatic pressure regulator so that no undue force can be exerted on the cables. It is of rather unusual interest that there is absolutely no braking arrangement on the cars themselves.

Topographic Features Favor Simple Design of Boston Garage

By G. W. Maker
Aberthaw Co., Boston

AN UNUSUAL opportunity for economical design offered itself in connection with the layout of a garage being built by the Aberthaw Co., Boston, for the North Terminal Corporation, of the same city. The building, a three-story one, was so designed as to eliminate all ramps or elevators. The only space within the building that is not occupied with car storage is taken up by stairways. This is due to the fact that the garage is to be built on a side hill and entrance to the first floor is on the lower block, the second floor in the middle of the side street, and entrance to the top floor in the rear. The structure will cover a ground area of 70,000 sq.ft. The east elevation is more than 300 ft. long. This street runs upgrade from the front of the building on a grade of approximately 5 per cent.

With this economical design practically the complete



PERSPECTIVE OF ECONOMICALLY DESIGNED GARAGE

area of the building on the three floors, or almost 200,000 sq.ft., is available for truck storage. There will be sufficient floor space to handle 800 of the largest trucks or a much greater number of commercial vehicles of average size.

In order to save excavation and expensive retaining-wall construction, approximately 20,000 sq.ft. in the deep corner of the lot will not be excavated for the first story. The progress schedule calls for quick completion for a building of this size, as it is desired to have the garage in full operation at the end of six months.

Meridian and Latitude Determination

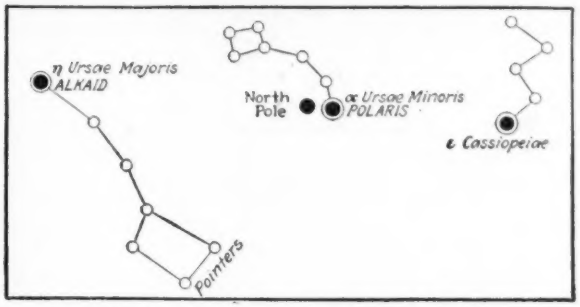
By Howard R. Ward
Wharton, N. J.

THE following method of meridian and latitude determination is simple, rapid, and accurate; computations are reduced to a minimum; accurate time is not needed; and the tables can be conveniently carried in a standard field book. The method is available whenever the stars are visible except as explained in "Note 3."

Meridian Determination—Set transit plates at zero. Point the telescope at POLARIS. Note the time. Unclamp upper plate and point telescope at ε CASSIOPEIAE or ALKAID, at moment when TIME INTERVAL (see table) has elapsed. Read horizontal angle, and multiply it by FACTOR (see table). Keeping lower plate clamped, lay off resulting angle towards ALKAID. Telescope now points to POLE.

NOTE 1. Repeat with telescope reversed and use mean result. Accuracy is within ten seconds if nearest degree of latitude has been used in FACTOR TABLE. For greater accuracy interpolate factor for intermediate latitude.

Latitude Determination—Level instrument carefully. Sight on POLARIS. Note vertical angle, calling it *A*. Note time. Sight at ALKAID or ε CASSIOPEIAE, preferably using whichever is highest, if not over 90 deg. altitude at moment when TIME INTERVAL (see table) has elapsed. Note vertical angle, calling it *B*. Subtract refraction correction (see table) from each angle, calling results *A′* and *B′*. Subtract lesser angle from greatest angle, calling result *C′*. Multiply *C′* by FACTOR (see table), calling results *D′*. If sighting on ε CASSIOPEIAE above POLARIS, or on ALKAID below POLARIS, subtract *D′* from *A′*; if sighting on ε CASSIOPEIAE below POLARIS, or on ALKAID above POLARIS, add *D′* to *A′*. The result is LATITUDE.



POSITION OF CONSTELLATIONS INVOLVED

NOTE 2. Repeat with telescope reversed and use mean result. Accuracy is within fifteen seconds if nearest degree of latitude has been used in FACTOR TABLE, and if REFRACTION CORRECTION is closely interpolated. If latitude is not known to nearest degree, estimate latitude and use first determination.

NOTE 3. In certain latitudes, at certain seasons, near culmination of the stars used, there may be a short period when one is too high and the other too low for observation. This is the only period to be avoided.

—REFRACTION—

Altitude	Correction
10°	5′19″
10½°	5′04″
11°	4′51″
11½°	4′39″
12°	4′28″
12½°	4′17″
13°	4′07″
13½°	3′58″
14°	3′50″
14½°	3′41″
15°	3′34″
15½°	3′27″
16°	3′21″
16½°	3′14″
17°	3′08″
17½°	3′03″
18°	2′58″
18½°	2′52″
19°	2′48″
19½°	2′43″
20°	2′39″
20½°	2′35″
21°	2′31″
21½°	2′27″
22°	2′23″
22½°	2′20″
23°	2′16″
23½°	2′13″
24°	2′10″
25°	2′04″
26°	1′59″
27°	1′54″
28°	1′49″
29°	1′45″
30°	1′41″
31°	1′37″
32°	1′33″
34°	1′26″
36°	1′20″
38°	1′15″
40°	1′09″
42°	1′05″
45°	0′58″
48°	0′53″
52°	0′46″
56°	0′39″
60°	0′34″
64°	0′28″
70°	0′21″
80°	0′10″

—1925 TIME INTERVALS—

Date	ε Cassiopeiae Min.	Sec.	Alkaid Min.	Sec.
Jan. 1	14	13	9	47
Jan. 15	14	28	10	03
Feb. 1	14	46	10	22
Feb. 15	15	01	10	39
March 1	15	14	10	53
March 15	15	24	11	04
April 1	15	30	11	10
April 15	15	32	11	12
May 1	15	28	11	08
May 15	15	21	11	00
June 1	15	10	10	49
June 15	14	56	10	34
July 1	14	40	10	17
July 15	14	24	10	00
Aug. 1	14	07	9	41
Aug. 15	13	52	9	25
Sept. 1	13	39	9	11
Sept. 15	13	28	8	58
Oct. 1	13	20	8	50
Oct. 15	13	16	8	46
Nov. 1	13	15	8	45
Nov. 15	13	20	8	50
Dec. 1	13	27	8	58
Dec. 15	13	38	9	10
Dec. 31	13	54	9	27

—1926 TIME INTERVALS—

Date	ε Cassiopeiae Min.	Sec.	Alkaid Min.	Sec.
Jan. 1	13	54	9	27
Jan. 15	14	10	9	44
Feb. 1	14	27	10	02
Feb. 15	14	44	10	21
March 1	14	56	10	33
March 15	15	06	10	45
April 1	15	13	10	52
April 15	15	14	10	53
May 1	15	12	10	50
May 15	15	04	10	42
June 1	14	53	10	30
June 15	14	38	10	15
July 1	14	23	9	58
July 15	14	07	9	41
Aug. 1	13	51	9	24
Aug. 15	13	36	9	07
Sept. 1	13	21	8	52
Sept. 15	13	10	8	40
Oct. 1	13	03	8	32
Oct. 15	12	59	8	28
Nov. 1	12	58	8	27
Nov. 15	13	02	8	31
Dec. 1	13	10	8	39
Dec. 15	13	22	8	52
Dec. 31	13	37	9	08

—FACTORS 1925—

Latitude	ε Cassiopeiae	Alkaid	Latitude	ε Cassiopeiae	Alkaid
20°	.04264	.02614	42°	.04134	.02382
21°	.04260	.02610	43°	.04123	.02356
22°	.04258	.02606	44°	.04110	.02326
23°	.04255	.02601	45°	.04096	.02291
24°	.04251	.02595	46°	.04080	.02250
25°	.04248	.02590	47°	.04064	.02200
26°	.04244	.02584	48°	.04046	.02134
27°	.04240	.02577	49°	.04027	.02037
28°	.04236	.02570	50°	.04005	.....
29°	.04231	.02563	51°	.03981	.....
30°	.04225	.02555	52°	.03954	.....
31°	.04221	.02546	53°	.03925	.....
32°	.04216	.02537	54°	.03892	.....
33°	.04210	.02527	55°	.03854	.....
34°	.04204	.02516	56°	.03811	.....
35°	.04197	.02504	57°	.03762	.....
36°	.04190	.02491	58°	.03705	.....
37°	.04182	.02477	59°	.03640	.....
38°	.04174	.02462	60°	.03553	.....
39°	.04165	.02445	61°	.03448	.....
40°	.04156	.02426	62°	.03302	.....
41°	.04145	.02405	63°	.03048	.....

—FACTORS 1926—

Latitude	ε Cassiopeiae	Alkaid	Latitude	ε Cassiopeiae	Alkaid
20°	.04243	.02602	42°	.04114	.02370
21°	.04240	.02598	43°	.04102	.02344
22°	.04238	.02594	44°	.04090	.02315
23°	.04235	.02588	45°	.04077	.02280
24°	.04232	.02583	46°	.04062	.02239
25°	.04228	.02578	47°	.04046	.02189
26°	.04225	.02572	48°	.04028	.02124
27°	.04221	.02565	49°	.04008	.02032
28°	.04216	.02558	50°	.03986	.....
29°	.04212	.02551	51°	.03962	.....
30°	.04207	.02543	52°	.03936	.....
31°	.04202	.02534	53°	.03906	.....
32°	.04196	.02525	54°	.03873	.....
33°	.04190	.02515	55°	.03836	.....
34°	.04184	.02504	56°	.03794	.....
35°	.04177	.02492	57°	.03745	.....
36°	.04170	.02479	58°	.03688	.....
37°	.04163	.02465	59°	.03620	.....
38°	.04155	.02450	60°	.03538	.....
39°	.04146	.02434	61°	.03432	.....
40°	.04136	.02415	62°	.03288	.....
41°	.04126	.02394	63°	.03036	.....

Bearing on Stiffener Angles

By A. W. A. Eden
Structural Engineer, East Orange, N. J.

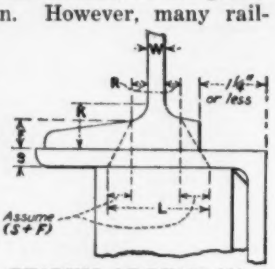
BUILDING code requirements in regard to stiffener angles are usually indefinite. Some plan examiners in building departments rule that the normal contact area of stiffener angles under loads or over bearings must not be figured at more than 16,000 lb. per sq.in.,

TABLE I—BEARING VALUES OF STIFFENER ANGLES

Bearing pressure at 24,000 lb. per sq.in. on outstanding leg less ½ in.; the two columns at the left give the value of a single vertical row of ¾-in. rivets in single shear at 12,000 lb. per sq.in. All values in 1,000-lb. units.

	¾ In. Riv.	*Outstanding Leg of Stiffener Angle* — 2½ In.		3 In.		3½ In.		4 In.		5 In.		6 In.	
No.	Value	Thick	Value	Thick	Value	Thick	Value	Thick	Value	Thick	Value	Thick	Value
3	15.9	5/16	15.0										
		⅜	18.0	5/16	18.8								
4	21.2	5/16	21.0	⅜	22.5	5/16	22.5						
		⅜	24.0										
5	26.5			5/16	26.3	⅜	27.0	5/16	26.3				
6	31.8			⅜	30.0	5/16	31.5	⅜	31.5				
				5/16	33.7	⅜	36.0	5/16	36.7	5/16	33.7		
7	37.1			⅜	37.6					⅜	40.5		
8	42.4							⅜	42.0				
9	47.7									5/16	47.2	⅜	49.5
10	53.0									⅜	54.0	5/16	57.7
12	63.6											⅜	66.0

since this is the value specified for short columns, notwithstanding the fact that rivets are credited with a bearing value of 24,000 lb. per sq.in. It is true that rivets, having their bearing area inclosed, do not give a really satisfactory comparison. However, many railroad bridge specifications allow 24,000 lb. for stiffener bearing, and it would seem logical to allow at least equal loading in buildings. On the other hand, the practice of many fabricators places very high loadings on stiffeners, especially those connected by more than four rivets.



BEARING OF BEAM ON STIFFENER WEB

Two tables given herewith will be found of great assistance in determining the required thickness of stiffener angle for any specified load. In the case of single stiffeners, the table for eccentric load is helpful.

Stiffeners Under Beam Seat—In case of a stiffener angle under a beam seat, where the outstanding leg is at right angles to the beam web, the bearing pressure on the web of the stiffener may be checked by the following formulas. The length of bearing L on the outstanding leg of the stiffener may be taken as indicated in the adjoining sketch; if the spread of the pressure area on either side is half the depth, the length will be

$$L = W + 2R + F + S$$

Since $R + F = K$ very closely, this may be written

$$L = W + R + K + S$$

TABLE II—ECCENTRIC LOAD VALUE OF SINGLE-RIVET ROW

Safe load in thousands of pounds on one vertical line of ¾-in. rivets spaced 3 in. center to center, at 5,300 lb.

$$\text{Load} = \frac{\text{Rivet Value } (N)\ (N+1)}{\sqrt{4E^2 + (N+1)^2}}$$

	Eccentricity										
No.	0	1½ In.	2 In.	2½ In.	3 In.	3½ In.	4 In.	4½ In.	5 In.	5½ In.	6 In.
2	10.6	7.5	6.4	5.5	4.7	4.2	3.7	3.4	3.0	2.8	2.6
3	15.9	12.7	11.2	9.9	8.8	7.9	7.1	6.5	5.9	5.4	5.0
4	21.2	18.2	16.6	15.0	13.6	12.3	11.2	10.3	9.5	8.8	8.2
5	26.5	23.7	22.0	20.3	18.7	17.2	15.9	14.7	13.6	12.7	11.8
6	31.8	29.2	27.6	25.9	24.1	22.5	20.9	19.5	18.2	17.1	16.0
7	37.1	34.8	33.2	31.5	29.7	27.9	26.3	24.6	23.2	21.8	20.6
8	42.4	40.2	38.7	37.0	35.2	33.5	31.7	30.0	28.4	26.8	25.4

From Job and Office

Hints that Cut Cost and Time

The web thickness W is somewhat less than the fillet radius R, and therefore we may write the preceding, for simplicity,

$$L = K + 2W + S$$

This formula applies to I-beams. For channels,

$$L = K + S$$

should be used, since W may be taken as approximately equal to $\frac{1}{2}F$.

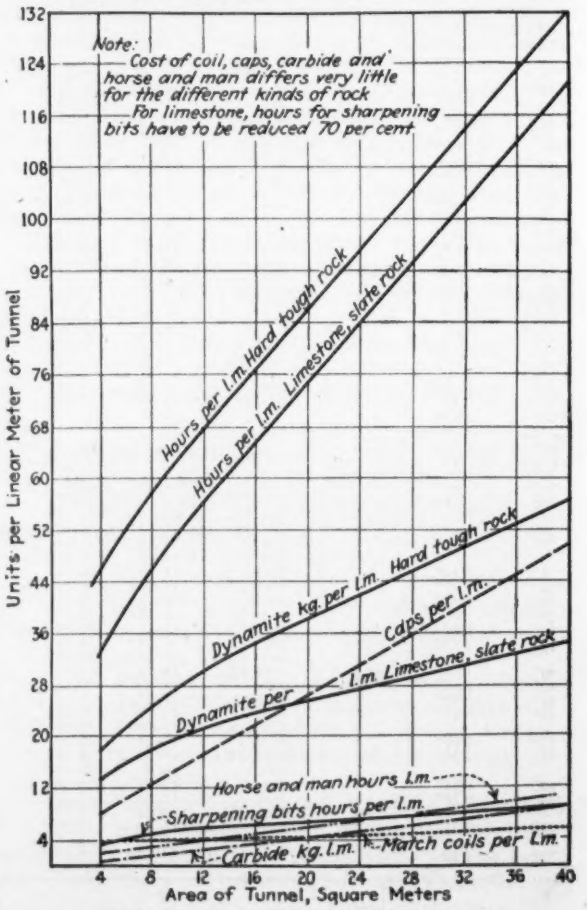
The assumed spread of the pressure area will be seen to be conservative, when it is noted that the safe projection of a plate is 0.576 times its thickness for a bearing pressure and bending stress of 16,000 lb. per square inch.

In all cases it is well to keep in mind the necessity of adequate length of bearing and thickness of seat angle.

Rock Tunneling Costs in Norway

By Elnar Moe
Civil Engineer, Nordlandsbanen, Groug, Norway

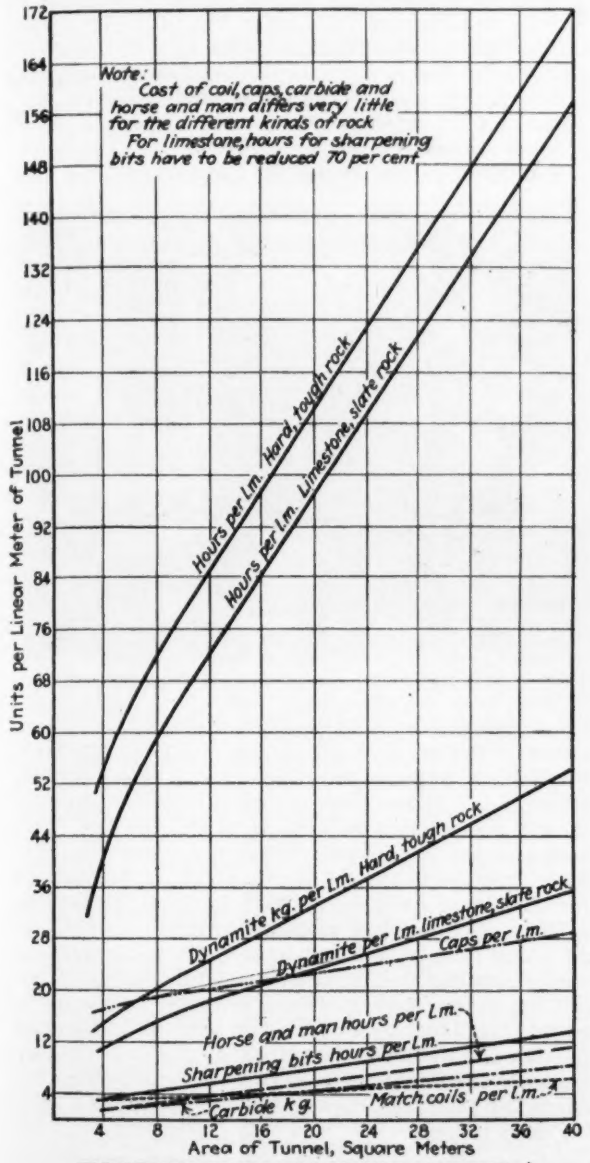
TWO cost graphs, for rock tunneling, which have been favorably received by Norwegian engineers, are given here. These graphs have been developed empirically from records of railway and water power



TUNNELING COSTS IN ROCK BY HAND DRILLING METHODS

From Job and Office

For Contractor and Engineer



TUNNELING COSTS IN ROCK BY MACHINE DRILLING METHODS

tunneling done by the writer during the past eleven years. This work was all in Norway. The assumptions required in using the graphs are: (1) The necessary means of conveyance of blasted rock is free to the muckers and (2) power loading is not employed. Assuming a hard rock and a 14 sq.m. section the manner of estimating costs from the graphs is given in the table.

	Machine Drilling			Hand Drilling		
Hours and Material	Unit per l/m. Tunnel	Price per Unit: Norw. Kr.	Amount: Norw. Kr.	Unity per l/m. Tunnel	Price per Unit Norw. Kr.	Amount Norw. Kr.
Hours	72	1.90	136.80	93	1.90	176.70
Dynamite (kg.)	32	4.50	144.00	26.5	4.50	119.25
Caps (pieces)	20	0.07	1.40	21	0.07	1.47
coil	4	0.60	2.40	3.5	0.60	2.10
Carbide (kg.)	3	0.75	2.25	3	0.75	2.25
Sharpening bits (hours)	4	1.80	7.20	6	1.80	12.80
Horse and man (hours)	6	2.00	12.00	4	2.00	8.00
			kr. 306.05			kr. 322.57
		—$47 per l.m.			$50 per l.m.	

Bridge Engineer Uses Airplane for Inspection Trip

AS AN example to the California Highway Commission of the advantage in using the airplane for field trips, the Aviation Service, U. S. A., on April 7 loaned a plane for the use of Harlan D. Miller, bridge engineer of the Commission, in making a trip down the San Joaquin Valley. Mr. Miller left Sacramento at 7:30 a.m., flew to the site of a bridge being built over the Kern River, 14 miles east of Bakersfield, and spent two hours with the resident engineer in charge of that work. On the return trip, he stopped at Fresno, spent an hour with the division engineer at that point and was back at Sacramento nine hours after leaving.

FLIERS OF THE CALIFORNIA HIGHWAY COMMISSION
Harlan D. Miller, center, bridge engineer, and Lt. L. D. Packard, right, president Sacramento Aviation Club and assistant bridge engineer, California Highway Commission, Army Sergeant at left.

The 700 miles traveled and the amount of work accomplished in the one business day by airplane would have required four days if done by automobile in the usual manner.

Move 62-Ton Excavators on Cars

TRANSFERRING two 62-ton gasoline-driven crawler-mounted dragline machines across the Imperial valley, in California, involved the crossing of two rivers which had no highway bridges strong enough to carry the load, but as the Southern Pacific Ry. has a line looping through the valley and reaching points near the new work it was decided to move the machines on cars. As the clear width between treads is 11 ft., or wider than a flat car, each machine was placed on a car with the treads straddling the floor.

Runways were cribbed on each side of a flat car, far enough apart and high enough to allow the machine to clear the car as it climbed under its own power. The runways were then lowered until the weight of the dragline rested on the car, the cribbing being then re-

moved. The machine was set with the center of its base about 4 ft. from one end of the car. The boom was then lowered until it just touched the blocking on the car ahead, so that little weight was supported by the car, thus allowing the boom to slide freely in going around curves. A gondola car was run in at the back end of the machine, the cab of which overhung this car and was jacked up and supported on its top. Three cars in all were used for each dragline. They were moved at a speed of four miles per hour, but care had to be exercised in going in and out of switches and around curves. On account of clearances it would ordinarily have been impossible to make shipment of a machine of this size on a main line, but through the co-operation of railway officials and the removal of switchstands and cattleguard fences the trip was successfully made over this branch line.

This transfer, described in the *Excavating Engineer*, was done under the direction of Ray S. Carberry, chief engineer, Imperial Irrigation District, Calixeco, Calif.

Precast Concrete Blocks Strengthen Road Joint Intersections

IN THE employment of various means to avoid breaking up of concrete road slabs at intersection joints, the California Highway Department has three noteworthy methods. In the first, expansion joints correspond to the typical section of the pavement but the four corners formed at the intersection with the center are reinforced with one ⅜-in. rod 8 ft. long joined at right angles with two ⅜-in. rods 4 ft. long spaced between. All rods are 2 in. below the top surface of the pavement. Standard expansion joints 2 in. wide were constructed at the end of each half day's run. This construction was used on a 2,000-ft. stretch of road.

On another stretch about 1,300 ft. long standard ex-

PRECAST BLOCK UNDER INTERSECTION OF JOINTS

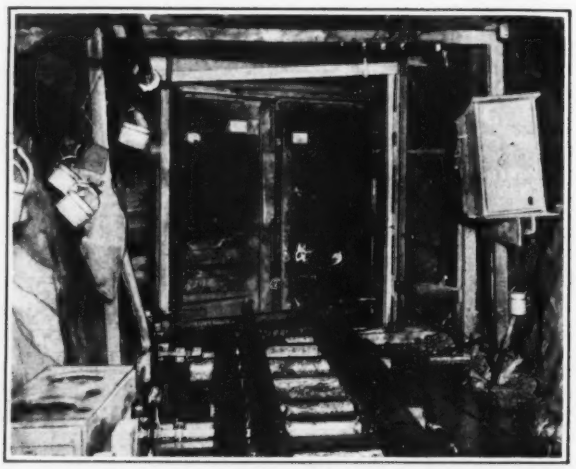
pansion joints with the reinforced corners to the center were used and in addition a precast concrete block 2 ft. square and 6 in. thick was buried in the sand subgrade with the top of the block level with the subgrade and the center of the block directly under the intersection of the longitudinal center joint and the transverse expansion joint. The bond between the top of the precast block and the under side of the pavement was broken by placing a piece of tar paper on top of the block.

A third method of reinforcing these corners was used on a stretch about a half mile in length. Here expansion joints were made 9 in. deep for the entire width of the pavement with the four corners in the center reinforced, the extra 3 in. in depth tapering out 2 ft. each side of the joint.

Ventilation System in Moffat Tunnel

ONE of the features of the ventilation system at the headings of the Moffat Tunnel, being driven through the Colorado Rockies, is found in the construction of the double doors in the bulkhead to keep the water tunnel clear. The doors are equipped with bumpers and counterweights so that trains are passed through without manual attention.

Ventilation is maintained by two blowers each hav-



DOUBLE DOOR AT TUNNEL BULKHEAD

ing a capacity at 4-lb. pressure of 4,000 cu.ft. per minute. The blowers are driven by 100-hp. motors. Twelve-inch 20-gage slip joint pipe is used for the blower line. It has been necessary, however, to reinforce the slip joints with bands to stop leakage. The high-pressure line is 7⅝-in. well casing, plain ends, with butt joints for the first 5,000 ft. and 6¼-in. well casing for the second 5,000 ft. Directly back of the heading 1,500 ft. of 3½- and 2-in. sizes are used for high-pressure air. Two fans, each driven by a 10-hp. motor, are also used, operating at ½ oz. pressure and delivering 12,000 cu.ft. of air per minute. These fans are located in the water tunnel just back of the last crosscut to the completely excavated main tunnel. They are operated continuously and discharge through a bulkhead to force the smoke and gases into the crosscut and out by the way of the main tunnel.

Job and Office Notes

Durability of Brown Print Paper, largely used in making negative prints of tracings, can best be conserved by keeping it stored in rooms where the temperature is not more than 35 to 40 deg. F., according to the Bureau of Chemistry of the United States Department of Agriculture. As is well known by engineers familiar with this class of paper, it loses much of its strength after it has been kept at normal temperatures for some time, and when the paper is old care must be taken in folding it because it will break along the folds. Although temperatures of some 35 to 40 deg. are not usually obtainable around the average drawing room, the knowledge that the lower the temperature the better the paper keeps may be of value to engineers who have to keep such a paper in stock for a considerable length of time.

News of the Week

CURRENT EVENTS IN THE CIVIL ENGINEERING AND CONTRACTING FIELDS

Earthquake Damages Buildings in Santa Barbara

Although detailed reports as to the damage done in Santa Barbara by the earthquake of June 29 are lacking it is evident from the reports that have come in that with few exceptions the majority of the important buildings in the city were not seriously damaged. The dam of Sheffield Reservoir which was built over the fault along which the movement occurred failed as did many water mains, but the Gibraltar dam, reported to have failed in the earlier reports, was undamaged. The water supply tunnel also was uninjured.

Reports as to the specific damage to buildings are still vague so it is too soon to tell what type of structure stood up best. The central section of the Arlington Hotel, reported but not confirmed to be a concrete structure, collapsed, as did the San Marcos building, also of reinforced concrete, while similar structures were only slightly damaged. The exterior wall of the new Hotel Californian fell away but the framework stood. It evidently was of steel frame construction. The railroads report little damage to roadway and none to tunnels and viaducts.

Reports from Montana where earthquakes started on June 27 state that the most serious damage was that done to the railroads by landslides.

Chicago Sanitary District Can Now Have More Bonds

Through a bill passed by the Illinois State Legislature and signed by Governor Small on June 19, the Sanitary District of Chicago is authorized to increase its bond issues from 3 per cent to 4 per cent, thereby increasing its limit of outstanding bonds from $57,000,000 at present to $76,000,000. With this amount the District can meet the obligations for sewage-disposal plant construction, as imposed by the Secretary of War in granting a withdrawal of 8,500 sec.-ft. from Lake Michigan. The bill carries a provision requiring a referendum on all issues after 1927 except those for the payment of downstate damage claims. The 5-year program laid out by the District calls for total expenditures of $59,576,000. In 1925, it is planned to spend $17,879,000; in 1926, $12,733,000; in 1927, $9,379,000; in 1928, $10,215,000 and in 1929, $1,370,000. As an indication of the increase in annual expenditures the following amounts indicate the expenditures for construction for the last five years, beginning in 1920 with $3,478,000; 1921, $6,875,000; 1922, $8,418,000; 1923, $4,487,000 and 1924, $8,493,000.

The permit calls for plants to care for 1,200,000 people. As laid out the plants will care for 1,440,000 people. On the north side plant. 40 per cent complete Jan. 1, will be spent an additional $18,177,000. The west side plant will require about $12,000,000. The industrial wastes of the stock yards, which produce a large amount of the floating solids, will be handled shortly in a $2,000,000 plant. According to the Board of Review, the stock yards wastes impose 21 per cent of the total load on the diluting systems. Harrison P. Eddy has recently reported on this plant, suggesting screens, an incinerator to burn the screenings and treatment of the screened sewage at the west side plant. In the 5-year program is a $14,000,000 miscellaneous item which will cover five bridges, dredging the Calumet River, completion of the McCormick highway and payment of damage claims in the Illinois River valley.

Engineering Fifty Years Ago

From *Engineering News*, July, 1875

THE American Society of Civil Engineers, like kindred associations in this country, has led a most precarious existence. Although founded nearly a quarter of a century ago, it is but recently that its present activity was developed, and its praiseworthy career of usefulness begun. It is now entitled to the highest rank among the few scientific associations of this country, and ere long must stand pre-eminent for its practical usefulness and genuine value, as a contributor to the general welfare of the entire community. Some of the most eminent scientific men of the nation are on its list of members, and the importance of the subjects which have been discussed at its meetings will be apparent from an examination of the papers published in the Transactions since 1874.

Forty Years with the Atlanta Water-Works

On April 25 W. M. Rapp, superintendent of construction and distribution of the waterworks of Atlanta, Ga., completed forty years of service with the water-works of that city. He began as office boy and meter reader in 1885 at a daily wage of $1 under William G. Richards, Superintendent. There were then 21 miles of water mains in the distribution system. After a few years Mr. Rapp was made foreman of pipe laying and in 1892 he was placed in charge of laying main pipe connections at the new pumping station and filter plant. Since then Mr. Rapp has been continuously connected with water construction in Atlanta, having been appointed superintendent of construction and distribution in 1905.

North Dakota Court Upholds City Zoning

A permanent injunction against the violation of the zoning ordinance of Bismarck, N. D., was granted on June 12, following a temporary one to the same effect by another judge. The Bismarck ordinance was passed under a state enabling act of 1923. The injunction restrains the defendant from going on with a four-family house on a street corner in a residence district, even though $3,000 had been expended on the foundations, because the building was flush with the sidewalk line at the front instead of 10 ft. back from the property line, as the ordinance requires, and because the side setback was only 15 ft. instead of 20 ft.

The defendant claimed constitutional protection against the taking of his property for public use without compensation. The court said, in part:

"By protecting the individual in his property, the state did not part with the power to protect itself or to promote its general well being.

"Where the interests of the individual conflict with the interests of the community, such individual interest is subordinate to the general welfare. There is usually a reciprocity of benefits resulting from limitations imposed upon the use of property by law.

"It has always been held that the government in its exercise of the police power may impose restrictions upon the use of property in the interests of public health, morals and safety.

"In later years legislatures have gone a step further, and courts have upheld the same restrictions may be imposed for the promotion of the public welfare, convenience and general prosperity of the community, and it is upon the latter theory this law stands.

"The purpose of the law is to enable cities to grow and develop in an orderly and harmonious way. The building line provision of the zoning ordinance adds to the beauty and convenience of the whole commuity.

"It is my conclusion that this ordinance, adopted in pursuance of legislative sanction, is not unconstitutional."

Central Pacific Plans 40-Mile Line in California and Oregon

The Central Pacific Railway Co. has applied to the Interstate Commerce Commission for authority to construct a new railroad line from a connection with its present line at Klamath Falls, Ore., to Cornell, Calif., a distance of approximately 40 miles. The Central Pacific is controlled by the Southern Pacific through stock ownership, and the proposed construction is a part of the general plan of that company for the development of south central Oregon and northeastern California. No plan for financing has yet been worked out.

Walter H. Fulweiler Elected President of A.S.T.M.

Walter H. Fulweiler, chemical engineer, United Gas Improvement Co., Philadelphia, Pa., was elected president of the American Society for Testing Materials at its annual convention at Atlantic City, June 22-26. Mr. Fulweiler was born in Philadelphia Jan. 3, 1880, and graduated from the University of Pennsylvania in 1901 with the degree of Bachelor of Science in Chemistry. For a year after graduation he was chemist for the Philadelphia Gas Works at its Station B and then for two years was with the Kansas City Gas Co. first as cadet engineer and then as superintendent of works, which position he resigned in March, 1904. From March, 1904, until October, 1906, Mr. Fulweiler was ranching in Mexico and traveling, and for a short time was engineer for the gas company at West Chester, Pa. In the fall of 1906 he returned to the Philadelphia Gas Works, Station B, as inspector of machinery, and the following August went to the Department of Tests of the United Gas Improvement Co., of Philadelphia, becoming chief chemist in 1913, chemical engineer in 1920, and also consulting chemist and chemical engineer for the U. G. I. Contracting Co.

Mr. Fulweiler was awarded the Beale Medal of the American Gas Institute in 1908 and the Grasselli Medal of the Society of Chemical Industry in 1922.

California to Get $34,000,000 for Roads in Next Two Years

The veto by the Governor of California of the bill proposing an increase in the gasoline tax from 2 to 3c. necessitated a corresponding rearrangement of the program for state highway work. An announcement of the status of state highway funds as of July 1, 1925, just issued by the commission, states that the total amount available from all sources for the next two years will be $34,000,000 of which $9,225,000 will be needed for work now under contract.

The proceeds of the two-cent gasoline tax now in effect are expected to be about $7,500,000 per annum to which will be added $3,500,000 from motor vehicle license fees, making a total of $11,000,000 per annum that will be available for maintenance and reconstruction.

The highway program gives particular attention to a new bill that requires maintenance of all traversable roads now in the state highway system on which no work has been done. Approximately 1,240 miles of road are affected by this new law.

For new construction the cash on hand is $2,300,000 and federal funds amount to $9,100,000, making a total of $11,400,000 for new construction in the biennium.

New Haven R.R. Organizes a Bus Transportation Company

Following the lead of the Boston & Maine R. R. and of the Great Northern Ry., the New York, New Haven & Hartford Railroad Co. has organized a subsidiary company to be known as the New England Transportation Co., to go into the bus transportation business in order to relieve the railroad of the unprofitable operation of some of its branch lines and to improve the service in other parts of its territory. The organization of the bus transportation company of the Boston & Maine R. R. was announced in *Engineering News-Record*, Dec. 25, 1924, p. 1049, and that of the Great Northern Ry. in the issue of May 28, 1925, p. 907. The Boston & Maine Transportation Co. is rapidly expanding its operations and includes in the route for which it now seeks approval an interstate line from Boston to Portland and a line to the White Mountains.

Motor Cars Go Through Numerous Bridge Railings

An automobile accident on a bridge in Washington on June 16 caused three deaths and has called forth a large amount of public criticism of the authorities for not having replaced a rather antiquated bridge. The accident occurred when the driver of the machine lost control while crossing the bridge. The car scraped a trolley pole in the center of the roadway, crossed the roadway and sidewalk, and went through the balustrade, dropping 75 ft. to the creek bed below.

The width of the bridge is only 40 per cent of the width of the street. The street railway rails are flush with the bridge flooring and when free of street cars the bridge can accommodate two lines of vehicular traffic in each direction. Disinterested bridge engineers point out that the bridge is more nearly adequate than other bridges in the District, but the central trolley poles add unnecessarily to the hazard created by the bridge.

A few weeks ago an automobile took out a section of the balustrade of another Connecticut Ave. bridge. In that instance the car did not follow through the opening it made, although nearly half of its length protruded over the edge. The two accidents have led to suggestions that the balustrades of all District bridges be reinforced with cable after the method being employed so successfully on country roads.

At Middletown, N. Y., an automobile while crossing a bridge on June 21 scraped the side of a car crossing from the other side and was swung outward, going through the railing into the stream and killing the driver.

On June 14 a newspaper truck crossing the Hampden County Memorial Bridge over the Connecticut River at Springfield, Mass., climbed the 5-in. curb and turning square to the roadway crossed the sidewalk and knocked out a 20-ft. length of concrete balustrade. The truck remained hanging over the edge of the floor and the driver was not injured.

Sanitary Measures at Dayton, Tenn., During Evolution Trial

In anticipation of the crowds expected at Dayton, Tenn., when the evolution trial begins there on July 10, Mayor Haggard and County Health Officer A. C. Broyles requested advice as to precautionary measures from the State Department of Health, which is now headed by Dr. E. L. Bishop, commissioner. Accordingly, on June 20, an inspection was made by Howard R. Fullerton, chief of the Division of Sanitary Engineering, in company with Dr. E. A. Lane, state epidemiologist. The two were accompanied by Dr. G. W. Rappleyea. Some of the main points in Mr. Fullerton's report are as follows:

It is expected that the present population of Dayton of some 1,800 will be increased during the trial to about 10,000. Chlorination of the present water supply, which is from a spring, is advised, and also the immediate connecting up with the water distribution system of a new well 2,000 ft. in depth owned by the city which has not yet been put in use.

The sewerage system now under construction for Dayton will not be completed by July 10, but Mr. Fullerton suggests that one of the main sewers might be completed as far as the court house and connections made between it and a special installation of water closets and urinals which he recommends for installation at the court house.

Suggestions are also made for temporary privies at various other points, including the already established tourist camp and near the numerous Pullman cars which are expected. Suggestions were also made for taking care of slop water at various points, for garbage and refuse disposal, and for a battery of public drinking fountains near the court house. The report includes directions for making as sanitary as possible the earth pit privies that Mr. Fullerton thinks should be provided.

$1,000,000 Raised for Museum of Engineering and Industry

At a recent meeting of the engineers and industrialists interested in the proposed museum of engineering and industry to be built in Washington as an adjunct of the Smithsonian Institution, it was announced that $1,000,000 had already been pledged toward the $10,000,000 which is to be raised for the museum. The names of the donors was not given out.

Prizes Offered for Mosque Design

The Egyptian Government has instituted a competition open to architects of any nationality for the reconstruction of the Mosque of Amrou, in Cairo. Prizes will be awarded of $12,500, $5,000, and $2,500 for the three best plans submitted to the Egyptian Minister of Religion by Jan. 1, 1927, accompanied by treatises on the subject. The Mosque was built in the year 658, by Amrou, the Arab conqueror of Egypt.

WASHINGTON NOTES

Encouraged by the success attained at the last session of Congress, when both Senate and House committees recommended the creation of a Federal City Planning Committee, a nation-wide bid for public support of the plan is now being made. Miss Harlean Jones, Secretary of the American Civic Association, will visit 30 states on such a mission this summer and fall.

A committee of 100 is co-operating in this effort to arouse the degree of public interest necessary to insure action by Congress. Frederic A. Delano is chairman of that committee. The legislation also is being supported actively by the American Institute of Architects, The American Society of Landscape Architects, the City Planning Institute and by a committee of engineers representative of all of the engineering organizations of the District of Columbia.

The Federal City Planning Commission, as approved by the Senate and House committees, would consist of an architect, a landscape architect, a municipal engineer and two other members, "all of distinguished experience in city planning." They would serve without compensation. In addition the commissioners of the District of Columbia, the Park Commission and Commission of Fine Arts each would add to the Commission a member of their own selection.

The principal witnesses to appear before the committees in opposition to the plan were Colonel Sherrill, Superintendent of Public Buildings and Grounds, and Colonel James F. Bell, engineer commissioner for the District of Columbia. Both are officers in the regular army attached to the Corps of Engineers.

The conception of a new commission is to correlate current activities which have a bearing on the city's plan as well as to work out the problems of future development, and to place these activities in the hands of men of the highest professional attainments.

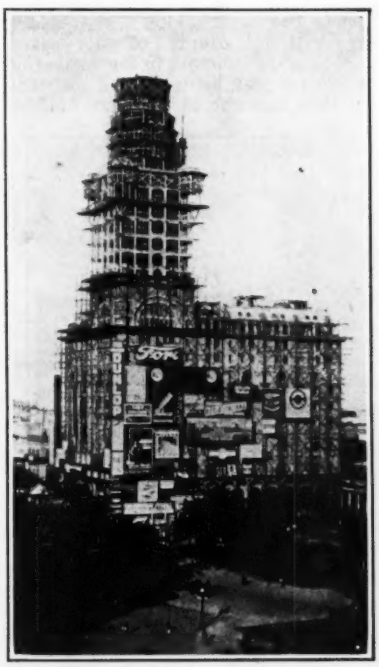
In announcing his intention to file petitions for rehearings in the Maple Flooring and Cement Manufacturers' Protective Association cases, the attorney general said: "Petitions for rehearing in these cases are in course of preparation and will be presented to the solicitor general within a few days. Leave was granted by the Supreme Court on June 8 to file such petitions within 30 days.

"The object of the petitions will not be to obtain a reconsideration of the principles of law enunciated by the Supreme Court in its recent decisions, but to point out that the evidence in these cases brings them within prior decisions of the Supreme Court, the authority of which has not been questioned. In other words, the government will not take the position that the Supreme Court erred in holding that the mere collection and dissemination of trade statistics is in itself unlawful but will endeavor to point out that the evidence in the records shows that both the Maple Flooring Association and the Cement Association were co-operating in the use of such information for the purpose of maintaining prices.

"The whole effort will be to show that the evidence leads irresistibly to the conclusion that the defendants, through their associations, had agreed to maintain prices and otherwise restrain trade within the prior decisions of the Supreme Court in the Hardwood Lumber and Linseed Oil cases."

Finley Retires from Presidency of Chicago & Northwestern

William H. Finley, president of the Chicago & Northwestern Ry. and of its subsidiary, the Chicago, St. Paul, Minneapolis & Omaha Railway Co., has retired on account of ill health. Mr. Finley entered the bridge and building department of the Chicago, Milwaukee & St. Paul Ry. in 1887 and remained with that company until in 1892 he went to the Chicago & Northwestern as engineer of bridges. Since that time he has been principal assistant engineer, assistant chief engineer, and, in 1914, chief engineer. In 1918 Mr. Finley was elected president of the Chicago & Northwestern Railway Co. to succeed R. H. Aishton who resigned to enter the service of the United States Railroad Administration. Mr. Finley is a past president of the Western Society of Engineers and of the American Association of Engineers.



Tallest Concrete Building

What is perhaps the tallest reinforced-concrete building in the world is under construction at Montevideo, Uruguay. It is the Palacio Salvo, and is 103 meters, or about 338 ft. high and of 28 stories.

West Palm Beach to Vote on $1,700,000 Bond Issue

The city of West Palm Beach, Fla., is to vote July 14 on a bond issue of $1,700,000. Of this amount, $660,000 is for park and playground improvements, $350,000 for fire and police equipment, $220,000 for seawalls, and $120,000 for sidewalks. Street paving already authorized, on which bids will be received on July 8, total over $1,000,000, and in addition to this paving $500,000 will be spent on additional storm sewers and $300,000 on street lighting. In addition to these expenditures, $1,000,000 is now being expended on water mains and gas-main extensions. These extensions with the minor improvements bring the total to be expended in the ensuing year to approximately $5,000,000.

Plans are now being prepared for the new city hall to be built on the water front and for a new central fire and police station.

Canadian Government Holds Up Ontario Hydro Plan

The Canadian Minister of Railways has announced that the Dominion Government will not consider the Ontario Hydro-Electric Power Commission's application for the right to erect a power dam at Morrisburg, Ont., until the International Joint Commission report on the general question of power development on the St. Lawrence River is made. He stated that any development of power on the St. Lawrence before the survey which is now in progress is completed would be contrary to the advice of the International Joint Commission.

Water Policy Commission of New Jersey Appoints Engineer

The New Jersey Water Policy Commission has retained Nicholas S. Hill, Jr., New York City, consulting engineer. The board was created by the last legislature to formulate a water policy for the state. For many years Mr. Hill was president of the Water Board of East Orange, New Jersey.

Standard Contract Forms Ready for Distribution

The standard contract forms for building and engineering construction are now ready for distribution. The standard contract for building construction as drafted by the Joint Conference on Standard Construction Contracts can be obtained from the American Institute of Architects, Octagon House, Washington, or from the Associated General Contractors of America, Munsey Building, Washington. The standard contract for engineering construction can be obtained from the Associated General Contractors headquarters.

The prices for both forms are identical, being as follows: Single copies, 20c. each; lots of 100 and less than 500, five per cent discount; lots of 500 and less than 1,000 ten per cent discount; lots of 1,000 or more, fifteen per cent discount.

East Bay Water Supply Plans Taking Shape

The East Bay Municipal Utility District has called for bids on a 350-ft. dam, on the Mokelumne River, a 90-mi. aqueduct, pumping plant and other auxiliaries, bids to be opened Sept. 4. The expectation is that if satisfactory bids are received the contracts can be awarded very shortly after the opening. A general description of the project as a whole appeared in *Engineering News-Record* Dec. 11, 1924, p. 960.

The suit brought by the district in the Superior Court of California, to establish validity of the $39,000,000 bond issue which resulted in an affirmation of validity, was appealed to the State Supreme Court on May 20. Argument on the appeal was set for July 20 and the decision must be handed down, according to law, by Aug. 20. The opening of bids was purposely timed to follow this date. There is every confidence in East Bay circles that the Supreme Court (which is the court of last resort in this instance) will uphold the decision of the lower court.

The work to be contracted will be sufficient to bring water from the mountain reservoir to the San Pablo reservoir on the outskirts of Oakland. Bids are being called for on the aqueduct on a location for gravity delivery and also on an alternative plan involving a pumping plant. The plans are so arranged that if an emergency develops next year, a temporary chlorinated supply can be taken from the San Joaquin River.

The capacity of the conduit in the upper reaches is sufficient to deliver a 10-m.g.d. supply to Stockton, and below this point enough extra capacity will be provided to supply the smaller cities along the aqueduct if they so desire.

Great Northern Ry. Financing Branch in Montana

The Great Northern Railway Co. has applied to the Interstate Commerce Commission for authority to issue $250,000 capital stock to be used in connection with the construction of a proposed extension of its Bainville-Scobey branch in Montana from Scobey to Opheim, a distance of approximately 50 miles.

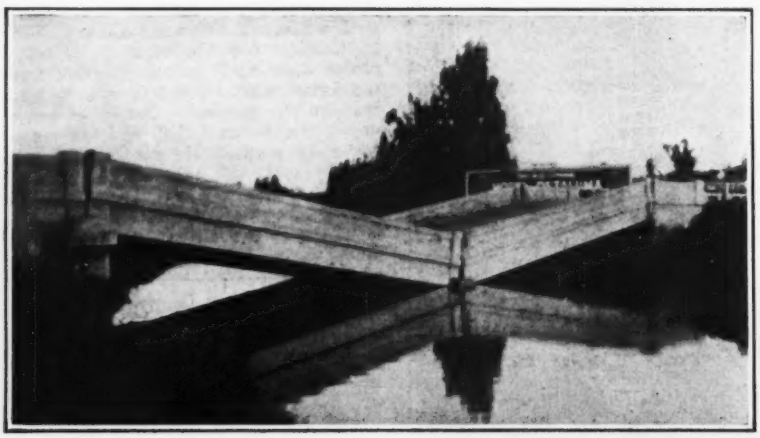
Municipal Council Disapproves Meter Contract Award

The proposed award of a contract for 5,000 water meters at $9 each, or $1.05 in excess of the lowest bid, recommended by the waterworks committee of the Minneapolis City Council was finally disapproved by the council after several weeks' delay. The committee advocated the acceptance of the higher bid because the make of meter offered had been in use by the city for years.

Bridge Pier Sinks Out of Sight

During a recent period of high water a concrete girder highway bridge across Willow Brook, Sonoma County, Calif., was destroyed by the settlement of the central pier which sank straight down about 8 ft. under the dead weight of the structure.

Willow Brook is virtually an arm of Petaluma Creek through which the effect of tides in San Francisco Bay reaches the bridge site. The bridge was built by county officials seven years ago, the concrete in the bottom of the central pier being poured on what was then thought to be solid foundation but which is now believed to have been a lens in the black tidal mud of the creek bottom. No piles were put down under the central pier and when scouring occurred during high water the central pier sank evenly, taking the two spans with it. There was no movement of the abutments but the two spans were badly cracked.



WILLOW BROOK BRIDGE WRECKED BY SINKING PIER

An entirely new bridge will be built at the site by the State Highway Commission, under whose jurisdiction this road has come since the construction of the bridge.

Delay in Bridge Contract Avoided

Further delay in the award of the contracts for the roadway and sidewalk slabs of the Philadelphia-Camden Bridge due to the controversy over the collection of tolls, noted in *Engineering News-Record* June 25, 1925, p. 1074, was prevented by the New Jersey commissioners agreeing to the award of the contract immediately rather than after the matter of tolls had been settled.

Random Lines

Page Duff Abrams

"Carpenter Falls into P. G. & E. Dam and Drowns" is the headline of a news item in the *San Francisco Examiner* of June 2. They will use too much water in their concrete!

* * *

A Conservative Exegesis

In calling the attention of "the average citizen" to the "full text of the fact-talk" by the port engineer of the port of Albany, N. Y., the *Knickerbocker Press* (Albany) says:

It shows that the port engineer is planning a port for The Capitol District that will have the same capacity as the port of Boston.

It shows why the Port of Albany will have an advantage over the ports of Boston, New York, Baltimore and Philadelphia.

It demonstrates why shippers will prefer to ship by the way of the Port of Albany.

Again, it shows that the port will give work for 6,000 men on the river front and between the piers and warehouses and in clerical work.

Which means 6,000 families spending upward of $1,000,000 a year in Albany and Rensselaer.

* * *

Our Animal Friends; Two Dispatches

Philadelphia.—In a Mid-Western city, according to the Pennsylvania Public Service Committee, a sewer became clogged. Workmen tried in vain to clear the obstruction without digging up the streets.

A snapping turtle was brought into service. A long string was tied to the tail of the reptile and it was released in the pipe.

The "race" was on. The turtle covered one block in 45 minutes and slowly plodded on. The second and third blocks were traversed and then it finally appeared at the end of the pipe, dragging behind him hundreds of feet of cord.

The obstruction was removed by the aid of the cord and the chelonian given his liberty in a swamp for its good work.

Boston—Engineers running a line of power cables from the Canadian side of Niagara Falls to Buffalo were halted when they found that the steel towers used to carry the wires over the stream were already loaded to capacity. Then they discovered an unused 4-in. gas main extending to the American side. A large sewer rat was captured, a stout string tied about its body and it was started through the pipe. Halfway across it refused to go farther. One of the engineers then conceived the idea of sending a weasel in pursuit of the rat. Not many seconds later the rat popped out on the American side. Heavier cord was pulled into the conduit and then the power cables were dragged through.

Engineering Societies

Calendar

Annual Meetings

AMERICAN SOCIETY OF CIVIL ENGINEERS, New York City; Summer Meeting, Salt Lake City, July 8-10, 1925.

AMERICAN PUBLIC HEALTH ASSOCIATION, New York City; Annual Convention, St. Louis, Mo., Oct. 19-22, 1925.

AMERICAN SOCIETY FOR MUNICIPAL IMPROVEMENTS, St. Petersburg, Fla.; Annual Meeting, Des Moines, Iowa, Oct. 26-29, 1925.

The American Institute of Steel Construction will hold its annual convention at White Sulphur Springs, W. Va., Nov. 11-14, 1925.

The National Safety Council will hold its 14th Annual Safety Congress at Cleveland, Ohio, Sept. 28-Oct. 2, 1925. The 14th Annual Safety Exhibit will be held in the Winton Hotel in conjunction with the safety congress.

The Colorado Section of the American Society of Civil Engineers recently elected the following officers: President, Lyman E. Bishop; vice-president, Fred R. Dungan, and secretary-treasurer, C. A. Betts, office engineer, Moffat Tunnel Commission.

The San Francisco Section of the American Society of Civil Engineers was addressed on June 17 by Secretary George T. Seabury. Reports of the Cincinnati meeting were made by C. E. Grunsky and Henry D. Dewell. The paper of the evening, "Moccasin Power Development, an Adjunct of the Hetch Hetchy Water Project," was divided into two parts, one of which was prepared by M. M. O'Shaughnessy, city engineer, San Francisco, and the other by N. A. Eckert, principal assistant city engineer.

Personal Notes

CHARLES W. SMITH, Portage, Wis., has recently been appointed city engineer for the city of Portage.

W. L. THOMPSON, consulting engineer, Greenville, Miss., has been appointed engineer-superintendent for the Indo-Burma Petroleum Co. for levee building, revetment and drainage work on and near the Irrawaddi River in Burma, India. This work is to protect the lowlands of the company from floods and to permit the extension of producing oil fields. Mr. Thompson left for England June 13. Before entering upon his practice as a consulting engineer, Mr. Thompson was for a number of years chief engineer of the Board of Mississippi Levee Commissioners at Greenville, Miss., and previous to that time he was employed upon the Panama Canal for a number of years.

DR. ELWOOD MEAD, commissioner, U. S. Bureau of Reclamation, received the degree of doctor of laws from the University of Michigan at its recent commencement at Ann Arbor.

H. W. HARTUPEE of Des Moines, Iowa, has been reappointed a member of the Iowa State Board of Engineering Examiners, for a period of four years beginning July 1, and will have charge of the Structural Division of the board.

ARTHUR E. LODER has resigned as manager of the Good Roads Department, California State Automobile Association, to take charge of general sales promotion for the Caterpillar Tractor Co., San Leandro, Calif.

MAJOR ULYSSES S. GRANT, 3RD, Corps of Engineers, has been ordered to Washington, D. C., from San Francisco, for duty with the Arlington Memorial Bridge Commission.

F. W. PEARSON, who recently resigned as city engineer of Prince Rupert, British Columbia, has been made superintendent for the contracting firm of McNamara Bros. of Sault Ste. Marie, Ontario.

W. CHASE THOMSON, consulting engineer, Montreal, has closed his office, having been appointed designing engineer to the Canadian section of the Joint Board of Engineers on the St. Lawrence deep waterway and power scheme.

EARLE B. MOSS, who resigned recently as city engineer of Niagara Falls, N. Y., to re-enter the employ of the Union Carbide Co., is now in Norway where he is engaged in engineering work for this company.

JOHN V. W. REYNDERS, president of the American Institute of Mining and Metallurgical Engineers, and consultant on steel properties, 120 Broadway, New York, was given the degree of doctor of engineering at the commencement of Rensselaer Polytechnic Institute of Troy, N. Y.; later he delivered the commencement address in which he stressed the growing dependence upon engineers in the social and economic sphere of the world's progress.

Obituary

HENRY L. COLLIER, consulting engineer, Atlanta, Ga., died in that city June 21. Mr. Collier was born in Atlanta in 1852 and graduated from the University of Georgia in 1872. From 1872 until 1887 he was on various railroad surveys and construction projects in the South. In 1887 he became chief engineer in charge of location and construction of the Atlanta & Florida R.R. (now part of the Southern Ry.) and later as a contractor rebuilt numerous bridges for the East & West R.R. of Alabama. In 1893 Mr. Collier was appointed examiner of surveys, U. S. Government, throughout the Western States which position he held until in 1898 he became chief engineer of location and construction on the Tifton & Moultrie R.R. in Georgia. Two years later he became chief engineer of location and construction on the Georgia & Florida Southern Ry. but in 1901 resigned to become commissioner of public works of the city of Atlanta. In 1910 he became consulting engineer to the Yellow Pine Manufacturers Association of St. Louis. In 1915 he returned to consulting practice in Atlanta.

CHARLES D. WEIRBACH, of the Pennsylvania Public Service Commission, died at Harrisburg, Pa., June 6, 1925. Mr. Weirbach was born in Hellertown, Pa., in 1870 and began work as a rodman for the city of Allentown, Pa. In 1891 he became principal assistant engineer for Jacoby & Weishampei and remained with that firm until, in 1896, he became a member of the firm of the Lehigh Engineering Co. and also borough engineer for Fountain Hill and Lehighton, Pa. From 1906 to 1918 Mr. Weirbach was city engineer of Allentown, Pa., resigning to become executive assistant to Admiral Bowles of the Emergency Fleet Corporation. In 1918 he was commissioned a major and assigned to the Construction Division, U. S. Army; he remained in the service until December, 1922, when he entered the employ of the Pennsylvania Public Service Commission.

EDWARD S. REID, vice-president and engineering member of the Board of Water Commissioners of the city of Detroit, Mich., died in Detroit June 13. Mr. Reid was born in Manhattan, Kan., in 1871, and graduated from the University of Michigan in mechanical engineering in 1893. In 1898 he was one of the founders of the Northern Engineering Works of Detroit and since that date has been vice-president and chief engineer in charge of design and production.

CHARLES W. EDDY, designing engineer, water supply, Waterbury, Conn., died from a heart attack June 18 while en route to his home in Thomaston, Conn.; his age was 49 years. Mr. Eddy had been with the city engineering force of Waterbury for 25 years, as transitman, resident engineer and designing engineer of the water supply, engaged on surveys and construction of several dams and reservoirs. He was born in Brunswick, N. Y., and was a civil engineering graduate of Connecticut State College.

HENRY F. PHELAN died at St. Louis, Mo., May 29, in his 56th year. Mr. Phelan was construction engineer for the World's Fair at St. Louis in 1903-4 and later went into private practice.

THOMAS M. LONG, retired civil engineer, 90 years old, died in New Orleans, La., where he resided with his daughter. Mr. Long had served for many terms as city engineer for Alton, Ill.

From the Manufacturer's Point of View

A Point of Contact Between Maker and User of Construction Equipment and Materials

Paving Brick Shipments and Orders Increase

The May statistical report of the National Paving Brick Manufacturers Association indicates that the paving season is well under way. Production of paving brick jumped from 28,444,000 brick in April to 32,177,000 in May. Shipments jumped from 18,738,000 in April to 25,690,000 in May. Stocks showed a decline for the first time this year being reduced from 139,223,000 in April to 131,689,000 in May. Unfilled orders recorded a sharp increase from 68,636,000 in April to 82,101,000 in May.

Thirty-eight plants representing 70 per cent of the industry's tonnage reported production for May at 86 per cent of their monthly normal capacity. Production during April was at 81 per cent of monthly normal capacity.

Principal Railroad Expenditures Near Five Billion Dollars

Expenditures made by Class I railroads in 1924 for wages, materials and supplies, and for improvements totaled $4,847,700,000, according to reports for the year received by the Bureau of Railway Economics from the railroads of this country. The principal expenditures of Class I railroads in 1924 were divided as shown in the accompanying table:

Wages paid for maintenance and operation	$2,629,902,000
Materials purchased, including fuel	1,343,055,000
Capital expenditures (including new equipment and improvements)	874,743,000
Total	$4,847,700,000

The total principal expenditures of the railroads in 1924 showed a decrease of $735,400,000 compared with 1923. This aggregate decrease was the result not only of a lower unit purchase price paid for a number of items of materials and equipment, but also of a smaller consumption of these items as a result of effective conservation. Among the materials and supplies purchased by the railroads were forest products, for which was expended $180,872,000 in 1924, a reduction of 22 per cent from the year before. Of that amount, $111,442,000 was spent for cross ties, 11 per cent less than in 1923, while 14 per cent fewer ties were purchased during the past year compared with the year before.

More than 27 per cent of the total steel production of the United States was purchased directly by the railroads or for them through equipment manufacturers in 1924. Total expenditure for iron and steel products made direct by the railroads during the year was $365,610,000. This was 21 per cent less than the expenditure for that purpose in 1923. In tonnage, the railroads purchased nearly 21 per cent less than the year before.

Approximately 2,210,800 bbl. of cement were bought directly by the railroads during the past year, 8.5 per cent less than in 1923. The total purchase price in 1924 was $5,141,000 or 16 per cent less than 1923. This does not include, however, direct purchases made by contractors engaged in railway construction work. Although many carriers maintain their own gravel pits and quarries where they meet their requirements for ballast without purchasing in the open market, nevertheless, approximately 14,265,000 cu.yd. of ballast were purchased in 1924 at a cost of $12,608,000.

French Mission Studying Paving Brick Industry in America

A mission composed of Leon Yeatman, president du Syndicat des Fabricants de Products Ceramiques de France, and Jean B. Fauchon, engineer of arts and manufacture, of France, is in this country studying the characteristics of American paving brick. In France immediately after the War the French government encouraged the building of brick plants to furnish building material for reconstruction purposes, and many such companies were formed. Much of the reconstruction work in France is now completed and the supply of building brick exceeds the demand.

The French building brick has been found to be too soft for road use, and it is the purpose of the present mission to examine American shales and fire clays in order to determine whether there is in France raw material suitable for the manufacture of vitrified paving brick. Thus far France has used chiefly concrete and macadam pavements but desires to foster the construction of more brick pavements because of their lower maintenance costs.

Business Notes

CHARLES N. RING, until recently works manager of the Allied Steel Castings Co., Harvey, Ill., has been appointed assistant director of the Electric Steel Founders' Research Group, succeeding W. J. Corbett, who recently resigned to become secretary-manager of the Steel Founders' Society of America. Mr. Ring has had over 15 years' experience in steel casting manufacture following his education at Washington University and the University of Missouri. At various times he has been connected with the American Steel Foundries, Commonwealth Steel Co., Illinois Steel Co., Laclede Steel Co., and the Ohio Steel Foundry Co. R. A. Bull is director of the Electric Steel Founder's Research Group which is composed of the Fort Pitt Steel Casting Co., McKeesport, Pa.; Lebanon Steel Foundry, Lebanon, Pa.; Michigan Steel Casting Co., Detroit; Nugent Steel Castings Co., Chicago, and Sivyer Steel Casting Co., Milwaukee.

GARDNER & LEWIS, INC., engineers and manufacturers specializing in protection against water and corrosion, has changed its name to the Lewis Asphalt Engineering Corp. It is said that the change of name carries with it no change in ownership, management or policy. The officers of the company are: R. W. Lewis, president and treasurer; R. B. Reid, vice-president and general manager; J. W. Winkler, secretary. Frank Russell is sales manager at New York, C. W. Merriken at Chicago, and A. A. Gould at Cleveland.

BUCYRUS CO., South Milwaukee, Wis., has announced the appointment of the Clyde Equipment Co., Portland and Seattle, as its sales representative for Washington, Oregon and northern Idaho. The Clyde Equipment Co. will carry a supply of spare parts for machines in the field, in addition to a complete line of Bucyrus equipment.

Equipment and Materials

New Company Formed to Make Centrifugal Concrete Pipe

For the manufacture of concrete pipe by the centrifugal process the American Hume Concrete Pipe Co., Detroit, Mich., has been formed and has acquired the American rights for the manufacture and sale of Hume concrete pipe and pipe manufacturing machinery. The Hume Pipe Co. of Australia owns the original patents on this process.

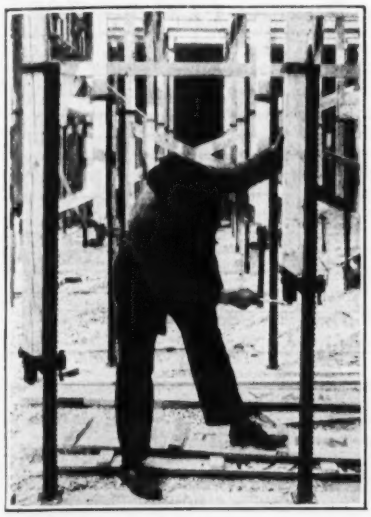
It is claimed that centrifugal pipe is lighter than ordinary concrete pipe. The method of manufacture is as follows: The reinforcement, consisting of longitudinal and spiral wires, is placed in a steel mold; at the end of the mold flanges are fixed of a depth equal to the thickness of the wall of the pipe desired. The mold is then laid horizontally on a machine consisting of friction rollers which revolve the mold. The necessary amount of concrete is inserted and is spread over the reinforcement by centrifugal force. The mold is revolved for about 5 min. after which it is steamed for 4 or 5 hours at a temperature of 100 deg. F. and then removed. The centrifugal action is also claimed to remove practically all the water so that no air pockets result. Collars used at the joints of the pipe are also made in the above described manner.

Standard lengths of pipe are 6, 8 and 10 ft. These lengths are made of a 1:2:2 mix in internal diameters ranging from 4 in. to 8 ft. The machinery for making this pipe is portable so that it may be transported to

any field of operation where there is a sufficient quantity of pipe to be manufactured.

Adjustable Shores

Symons Clamp & Mfg. Co., Chicago, has designed an adjustable shore whose adjustment range is 5 ft. at 1 in.



centers. It also has a 2½-in. secondary screw adjustment, and can be adjusted in the upward direction under full load. The locking device does not depend on a gripping action and is independent of the load on the shore. The supporting members are high carbon steel and will support a safe load of 10,000 lb. Another feature of this shore is the fact that no loose or detachable parts are required and no separate tools or jacks are necessary for operating it. The shores may be either purchased or rented. The weight of the shore complete without the 4x4s is 34 lb.

Machine Finishes Road Shoulders Rapidly and Accurately

Contractors using hand labor for finishing the earth shoulders on concrete roads often experience difficulty in getting a sufficiently long stretch completed and accepted before some portion of it is washed out or cut up by wagon ruts. To facilitate more rapid shoulder work, the Highway Shoulder Machine Co., Effingham, Ill. has developed the machine shown in the illustration.

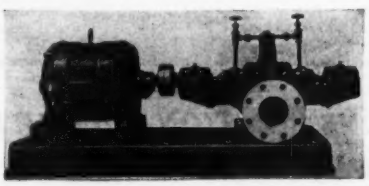
The wheels of the grader ride on the

pavement and the blade can be fixed to the exact slope and lines required for the shoulder. The framework is of structural steel and the wheels are of steel with solid rubber tires. The main castings are of cast steel and the others are of cast iron. The vertical adjustment of the blade has a range of 8 in.; the slope of the main blade is adjusted by a screw and pivot device which can be locked in position for any slope required. The angle of the blade is regulated from the operator's seat with hand wheel and chain attachment, as is also the steering of the machine. The auxiliary slope blade can be adjusted to any required position.

The number of passes required depends upon the accuracy with which the shoulder material has been distributed by the grading equipment. Ordinarily it requires from one to three passes to produce the final finish. From one to three miles of shoulder can be finished in a day. The total weight of the machine is about 2,800 lb.

Small-Size Centrifugal Pump

The Wilson-Snyder Manufacturing Co., Pittsburgh, is marketing a new series of centrifugal pumps of small size to supplement its line of larger pumps. The new pumps are intended to meet the demand for a high-grade, bronze-fitted, double-suction pump at a reasonable price. The sensitiveness usually experienced with small centrifugal pumps has been eliminated, it is claimed, by simplicity of design and ruggedness of construction, proof of

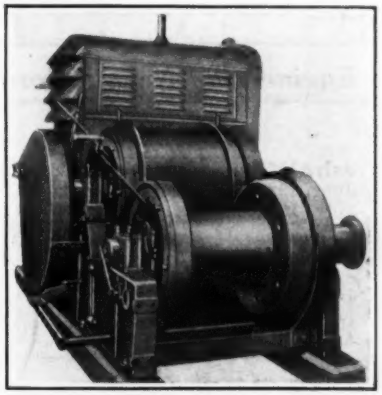


which is attested by the fact that the pumps during testing were frequently run out of alignment, at very high speeds, and with packing excessively tight. Even under these severe conditions they functioned well. Complication of design has been avoided, which permits emergency repairs to be made in a machine shop. The pumps operate with Westinghouse motors at their standard speeds of 1,150 r.p.m. and 1,750 r.p.m. for both d.c. and a.c. current.

New Multiple Unit Belt Hoist

A new belt hoist, manufactured by the H. & O. Machinery & Engineering Co., Newark, N. J., embodies principles in its design that permit adaptability to various uses. The basic equipment is a belt-driven hoist equipped throughout with S. K. F. ball bearings and Hyatt roller bearings. To this single drum may be added not only power drive, but also one or two additional drums. Another refinement lies in the Alemite system of lubrication.

The drum is released by power instead of a spring between the gear and the drum. The power drive may be changed from gasoline to electric without making any changes in the motor supports. Slots at right angles to each other permit of adjustment in any direction. In addition to this, the motor support is made separate from the



main housing and arranged so that tightening of foundation bolts does not destroy the theoretical gear centers between the motor pinion and gear, which is one of the causes of excessive wear and noisy operation. The friction gear teeth are arranged so as to create a continuous circulation of air tending to keep the friction from overheating.

Publications from the Construction Industry

Pumps and Compressors—DOMESTIC PUMP & ENGINE CO., Shippensburg, Pa., is distributing Bulletin 25-MC in which is described its line of power units consisting of pumps, air compressors, and hoists. The booklet contains specifications covering size, capacity, shipping weights, and speeds.

Brick Pavements—NATIONAL PAVING BRICK MANUFACTURERS ASSOCIATION, Cleveland, Ohio, has recently issued a booklet called "Two-Sided Value," in which it stresses the economy of relaying old bricks on new foundations. Descriptive and cost data from a number of cities where such procedure was followed are given.

Diamond Drills—E. J. LONGYEAR CO., Minneapolis, Minn., in catalog 7, a 60-p. book, describes its line of diamond core drills and attachments. In addition to the technical descriptions and tables, there are included a history of diamond drilling operations and descriptions of current practices. The book contains a detailed index and is well illustrated.

Water Supply—WALLACE & TIERNAN CO., Newark, N. J., in a pamphlet called "What Is Pure Water?," tells the story of the development of chlorination as a method of water treatment. This is one of a series of pamphlets discussing various phases of public health engineering and the relation of the sterilization of water supplies, disinfection of sewage, and the sanitation of swimming pools to the public health.

Engineering News-Record Statistics of the Construction Industry

July 2, 1925 — *in the United States* — Vol. 95, No. 1

Engineering News-Record CONSTRUCTION COST Index Number (1913 = 100)

MONTHLY

Jan. 1924 to Date

July, 1925	**204.60**
June, 1925	204.60
July, 1924	214.40
Peak, June, 1920	273.80
1913	100.00

1924

Jan.	217.90	May	222.33	Sept.	211.25
Feb.	220.30	June	216.85	Oct.	207.55
March	224.60	July	214.40	Nov.	205.70
April	221.60	August	213.15	Dec.	208.58

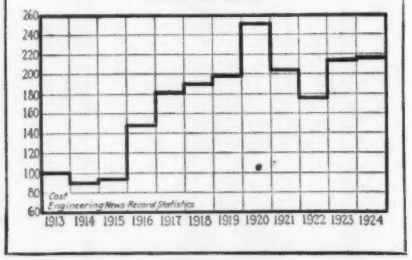
1925

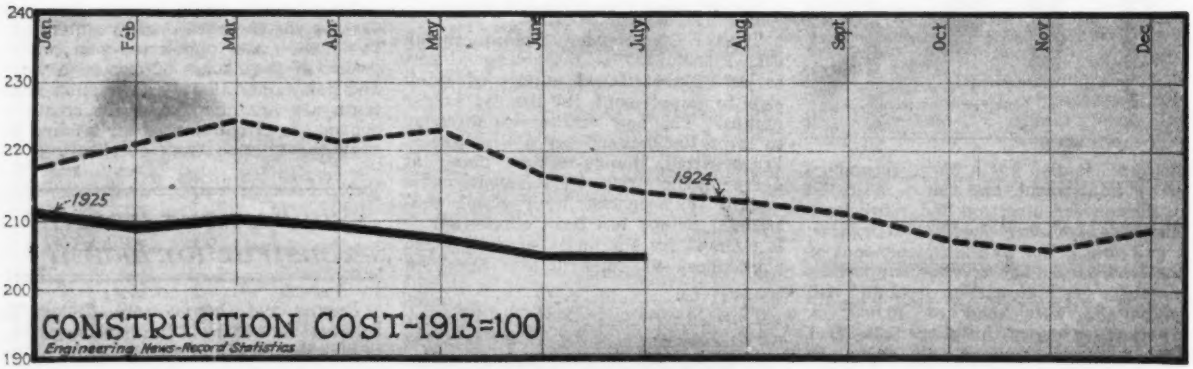
Jan.	210.40	March	210.20
Feb.	209.70	April	209.55
May	207.20		

ENGINEERING NEWS-RECORD'S Construction Cost Index Number remains unchanged from the June 1 level, owing to lack of fluctuation in prices of basic building materials and labor. The average rate for common laborers is 53c. per hr. for the entire country. The same rate prevailed a month ago as against 56c. per hr. in July, 1924. Thus general construction cost is 4 per cent lower than one year ago and 25 per cent under the peak; it is 105 per cent above the 1913 level.

YEARLY

1913 to 1924





Engineering News-Record CONSTRUCTION VOLUME Index Number (1913 = 100)

MONTHLY

Jan. 1924 to June, 1925

June, 1925	**214**
May, 1925	209
June, 1924	149
Peak, May, 1922	221
1913	100

1924

January	125	May	194	September	159
February	144	June	149	October	164
March	161	July	161	November	128
April	159	August	162	December	145

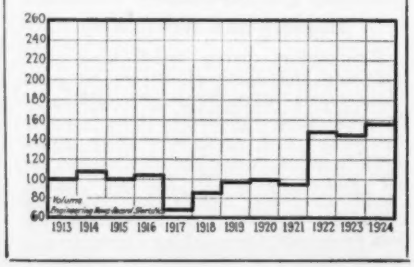
1925

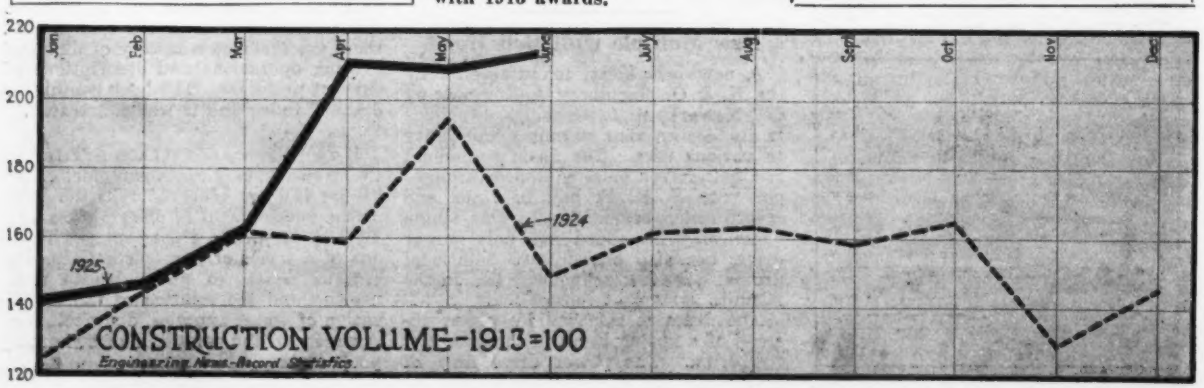
January	141	March	161
February	145	April	211

ENGINEERING NEWS-RECORD'S Construction Volume Index Number is 214 for the month of June, and 154 for the whole of 1924, as against 100 for 1913. This means that the actual volume of construction in 1924 (not the mere money-value of the contracts let that year) is 54 per cent above the volume of construction for 1913. The monthly volume number, 214 for June, 1925, contains the increment of construction and indicates the rate at which contracts are being let as compared with 1913 awards.

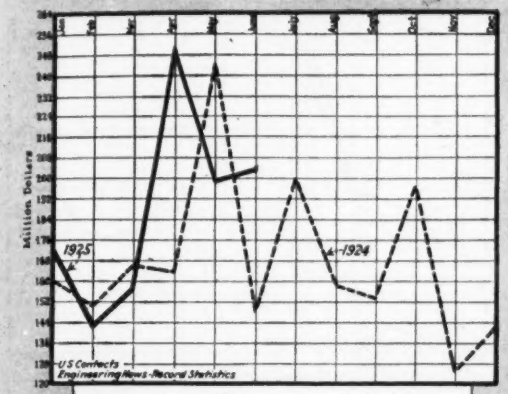
YEARLY

1913 to 1924

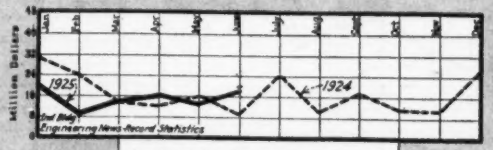




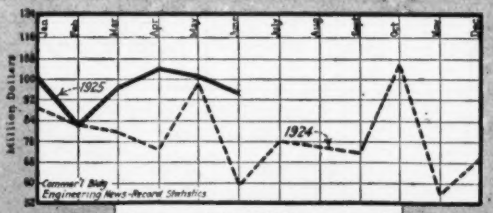
Monthly Statistics of the Construction Industry



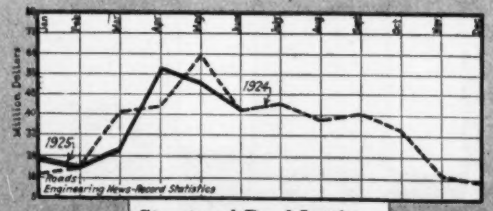
Contracts Awarded in the United States
Reported in E. N.-R.



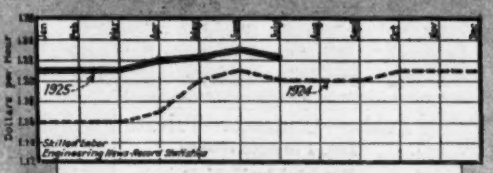
Industrial Building Awards
$40,000 and Over



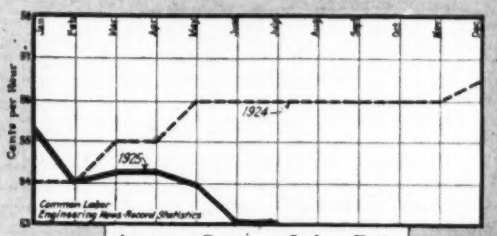
Commercial Building Awards
$150,000 and Over



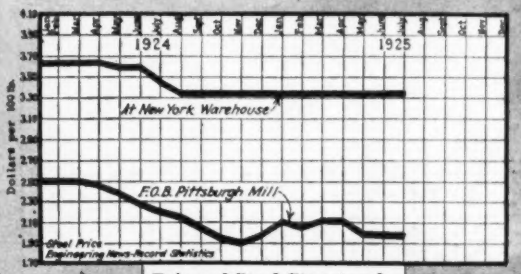
Street and Road Lettings
$25,000 and Over



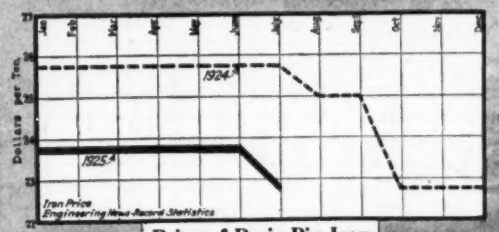
Average Wage of Skilled Building Trades
Bricklayers, Carpenters and Steel Erectors



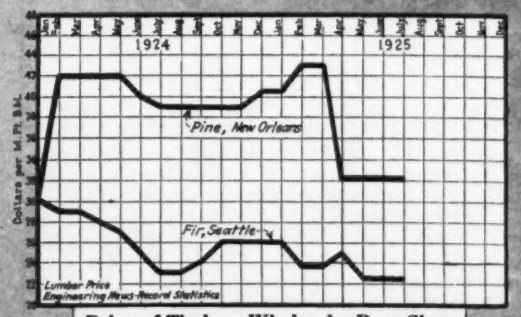
Average Common Labor Rate
Pick and Shovel Men



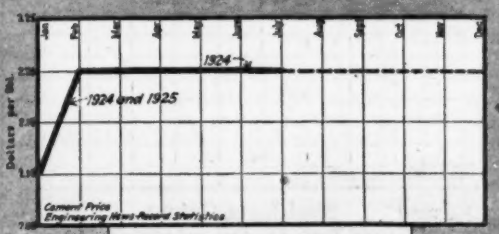
Price of Steel Structurals
Shapes 3-In.; Plates ¼-In.



Price of Basic Pig Iron
F.o.b. Pittsburgh

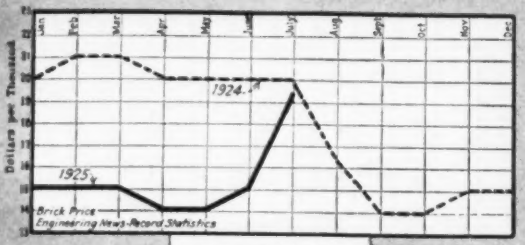


Price of Timbers, Wholesale, Base Sizes
Car Lots to Contractors

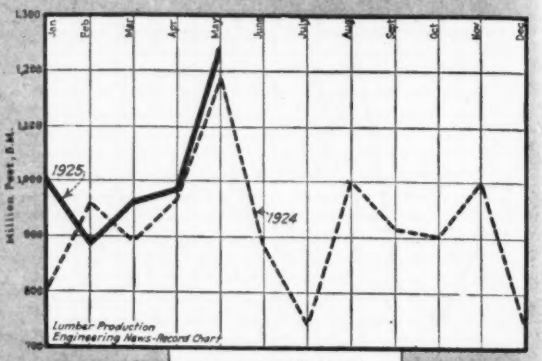


Net Price of Portland Cement
Car Lots, F.o.b. Chicago

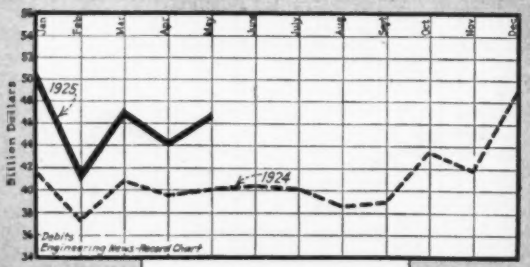
Monthly Statistics of the Construction Industry



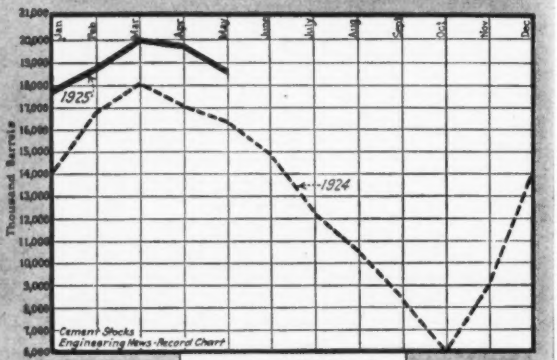
Price of Brick
At Dock, New York



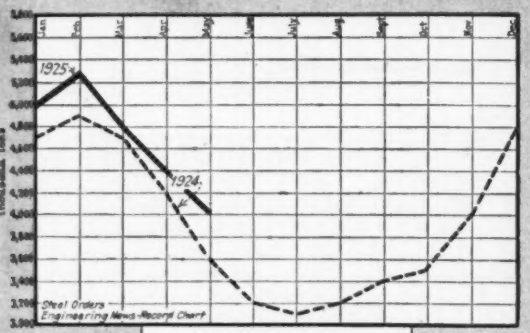
Lumber Output
Nat. Lumber Mfrs. Assn.



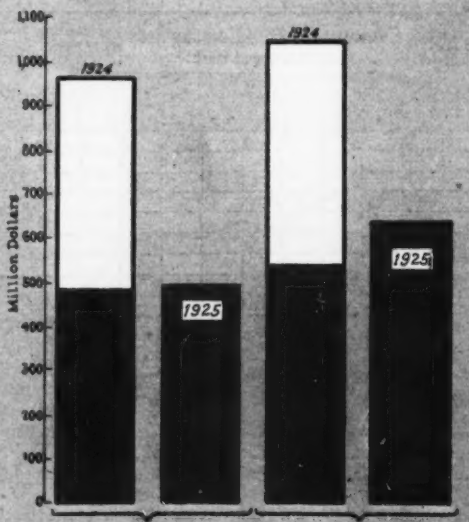
General Business Trend
Bank Debits—Federal Reserve



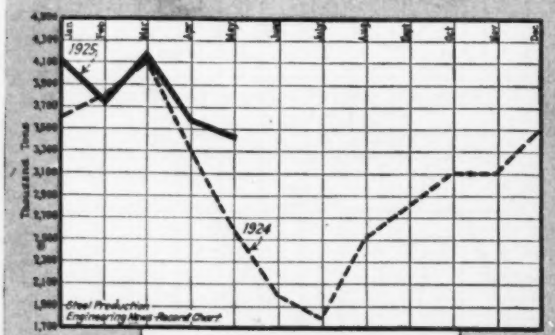
Cement Mill Stocks
Geological Survey



Unfilled Tonnage
On Books of U. S. Steel Corp.



Public—Contracts—Private
Jan. 1 to date
Reported by E. N.-R.



Steel Ingot Output
Gross Tons; Am. Iron and Steel Inst.

Value of June Contracts 2 Per Cent Ahead of Preceding Month and 38 Per Cent Greater than Same Period in 1924

ENGINEERING construction contracts awarded during June, gained 2 per cent in money value over those of the preceding month and were 38 per cent greater than lettings for the corresponding month last year.

All construction, Jan. 1 to July 1, 1925, is 11 per cent ahead of the same period in the record year 1924.

Comparing June with May, the gain in money value is confined to big bridge jobs and industrial buildings.

Proposed work for the first four months of 1925, however, shows a strong trend toward commercial buildings and public work. Many of these projects will reach the contract stage during the last half of the current year, therefore a gain may be looked for in the direction of these two classes of construction.

The gain in June over the same month last year affected all parts of the country alike. The increase over May, however, was general, with the exception of the Middle Atlantic states.

The tendency is toward an increased volume of construction in all parts of the country except the South, the Middle West and the Far West. The states immediately west of the Mississippi are active.

Minimum costs observed in the table below are: Water-works, and excavations, $15,000; other public works, $25,000; industrial buildings, $40,000; commercial buildings, $150,000.

Principal among the large projects of the month were: Subway, New York, N. Y., $3,997,000; office building, Detroit, Mich., $3,000,000; hotel, New York, N. Y., $3,000,000; hydro-electric development, Saluda, N. C., $2,000,000; cement mill, San Andreas, Calif., $2,000,000; administration building and dormitories, Maplewood, N. J., $2,000,000; bridge, Twin Cities, Minn., $1,332,984; bridge, Portland, Ore., $1,135,843.

Business Briefs

Call money quoted at 4½@6 per cent, June 29; year ago, 2 per cent.

Time loans: short terms, 3¾@4 per cent; longer periods, 4@4¼ per cent.

Commercial paper: best names, 4 per cent; other names, 4¼ per cent.

FOREIGN EXCHANGE (DEMAND)

	Par	This Week	Last Week	Year Ago
Sterling	$4.86⅔	$4.85⅞	$4.85⅞	$4.32
Franc	.193	.0452	.0466	.0527½
Lira	.193	.0355½	.0375½	.0431¼
Mark	.238	.238	.2380⅛	.....
Florin	.402	.4004	.4009½	.3755
Peseta	.193	.1452	.1455	.1340
Krona	.268	.2678½	.2674	.2652

Value of Contracts Let in the United States and Canada, June, 1925

	New England	Middle Atlantic	Southern	Middle West	West of Mississippi	Far West	United States	U. S. Jan. 1 to July 1	Canada
Water works	$672,000	$730,000	$112,000	$895,000	$751,000	$26,000	$3,186,000	$32,527,000	$274,000
Sewers	116,000	1,854,000	226,000	1,654,000	727,000	722,000	5,229,000	34,534,000	303,000
Bridges	485,000	1,435,000	2,090,000	1,262,000	2,117,000	3,352,000	10,741,000	34,821,000	80,000
Excavation, dredging, etc.	17,000	49,000	204,000	165,000	251,000	525,000	1,213,000	6,045,000	339,000
Streets and roads	1,708,000	7,602,000	5,838,000	10,652,000	10,157,000	6,494,000	42,451,000	224,117,000	2,460,000
Industrial building	2,997,000	1,932,000	4,448,000	2,277,000	3,251,000	3,175,000	18,080,000	88,835,000	1,115,000
Commercial building	14,282,000	33,158,000	5,757,000	16,074,000	14,275,000	12,095,000	95,641,000	601,030,000	525,000
Federal government	77,000	813,000	573,000	34,000	256,000	506,000	2,259,000	19,661,000	.....
Unclassified	154,000	10,118,000	4,622,000	980,000	8,031,000	704,000	24,609,000	102,928,000	3,419,000
June, 1925	$20,508,000	$57,691,000	$23,870,000	$33,993,000	$39,818,000	$27,599,000	$203,479,000	$1,144,498,000	$8,515,000
June, 1924	10,095,000	44,983,000	12,779,000	31,947,000	24,205,000	22,992,000	147,001,000	.....	8,139,000
May, 1925	16,918,000	76,417,000	13,619,000	33,012,000	39,230,000	20,009,000	199,205,000	.....	11,727,000
1925, Jan. 1 to July 1	100,013,000	387,190,000	97,189,000	203,005,000	210,097,000	147,004,000	1,144,498,000	.....	40,254,000
1924, Jan. 1 to July 1	61,278,000	352,994,000	117,623,000	210,190,000	168,850,000	147,529,000	1,027,030,000	.....	57,347,000

Labor Rates and Conditions Throughout the Country

WITH the demand for high priced apartments and factories fairly satiated, the construction industry is finding an outlet for its forces in the unsatisfied requirements for stores, power plants, public projects, offices, private and commercial garages and small one-family dwellings.

Aside from the long-standing jurisdictional dispute existing between bricklayers and plasterers in several large cities, the outlook for construction is greatly favored by developments in the direction of price stability and a gradual reduction in the number of strikes occurring among building trades mechanics.

Looking in the direction of other industries, it is observed that most indications there, are also favorable, particularly with regard to agriculture, oil and the automotive industry.

Some of the other good points in the situation are: Gain in bank deposits; increased bank debits or check payments; freight loadings (cumulative) heaviest for the past five years; favorable trade balance (export and import); slight drop in cost of living, mostly in retail clothing and fuel prices (National Industrial Conference Board); slower production but increasing demand in textiles, leather and copper; increased output of building materials, other than steel.

Against all the above mentioned factors, are: slower mill operations in iron, steel, flour and other food products; inactivity in demand for several of the smaller steel items; a downward trend in wholesale food prices (Bureau of Labor Statistics) offset by an increase in retail costs, a condition where the benefit is confined mainly to the retailer; trend toward over-development in production capacities of such industries as iron, steel, coal, glass, boots and shoes (U. S. Secretary of Labor).

More common laborers left the United States, according to the Conference Board, than were admitted during the first ten months of operation of the Immigration Act of 1924. The number admitted was 27,908, while 44,750 of this class departed, leaving a net deficit of 16,842. There were 13,352 farm laborers admitted and of these 1,232 departed, leaving a net gain of 12,120 for the ten-months period. The common labor rate for the nation is 53c. per hr., compared with the same rate one month ago and 56c. per hr. in July, 1924. Local conditions in the building trades follow:

Atlanta—Slight surplus of building craftsmen and other trades.

Baltimore—Labor supply in excess of demand despite activity in construction.

Birmingham—Oversupply of common laborers, which can be obtained at times for a rate as low as 20c. per hr. for non-union men.

Boston—Employers refuse arbitration in strike of building trades mechanics. Value of building construction in Greater Boston liable to be tied up is estimated at $30,000,000.

Dallas—Small surplus of all trades except bricklayers. Building construction gaining.

Denver—Increased activity in construction and other industries. Scarcity of bricklayers and plasterers.

Detroit—All industries operating at a fairly good rate. Labor conditions in the building trades apparently satisfactory to employers and employed.

Kansas City, Mo.—Surplus of common laborers despite farm requirements. Most industries on full time basis. Skilled trades plentiful.

Minneapolis—Demand sufficiently active to take up excess laborers. Building trades mechanics in good demand.

Montreal—Surplus of common laborers. Unemployment situation greatly improved.

New Orleans—No revised schedule went into effect July 1, the beginning of the new wage year. Hoisting engineers now receiving $1 per hr. ask an increase of 25c. per hr.; general contractors show no disposition to meet the request owing to slackening of work in that line.

New York—With the largest volume of building under way, of any of the leading cities of the country, New York is developing a shortage of skilled mechanics such as bricklayers, carpenters, painters, etc. In other lines employment conditions are also showing improvement.

Current Building Trades Wage Rates Per Hour

(Higher rates indicated by +, decreases by —)

Cities	Bricklayers	Carpenters	Hoisting Engineers	Hod Carriers	Pile Drivers	Structural Iron Workers	Common Labor
Atlanta	$1.12½	$0.70	$0.70	$0.50	.....	$0.75	$0.25@.30
Baltimore	1.50@1.75	1.00@1.20	1.00@1.12½	1.00	$0.65	1.12½	.40
Birmingham	+1.00@1.75	.35@.87½	.75@1.25	.50@.75	.....	+.75@1.75	.20@.40
Boston	1.25	1.10	1.10@1.30	.70@.75	1.10	1.10	+.50@.75
Cincinnati	1.50	1.25	1.25	.92½	1.25	1.25	40@55
Chicago	1.50	1.50	1.50	1.25	1.50	1.50	.75@.87½
Cleveland	1.50	1.25	1.30	.87½	1.00	1.50	.87½
Dallas	1.50	1.00	1.00	.40@.75	.87½	1.00	.30@.50
Denver	1.62½	1.12½	1.12½@1.18¾	.81¼@.87½	1.00	1.15¾	.35@.55
Detroit	1.50	.70@1.00	.85@1.00	.90	.85@1.00	1.12½	.50@.60
Kansas City	1.37½	1.12½	1.12½@1.25	.90	1.25	1.25	.40@.75
Los Angeles	1.25	.87½	.75	.75	.75	.87½	.43¾
Minneapolis	1.12½	.87½	.87½	.71½	.....	.87½	.50@.55
Montreal	.90	.45@.65	.62½	.30@.35	.50	.65	.25@.30
New Orleans	1.25	.90	1.00	.65	.85	1.25	.35@.40
New York	1.50	1.31¼	1.50	1.00	1.00@1.12½	1.50	.50@.75
Philadelphia	1.50	1.12½	1.02½	1.12½	1.00	1.12½	.40@.45
Pittsburgh	+1.62½	1.37½	+1.43¾	1.00	.....	1.37@1.43¾	+.75
St. Louis	1.75	1.50	1.50@1.65	1.15@1.25	1.50	1.50	.45@.77½
San Francisco	1.25	1.00	1.00	.81¼	1.00	1.12½	.50@.55
Seattle	1.37½	1.12½	1.00@1.12½	1.00	1.00@1.12½	1.12½	.50@.62½

Philadelphia—Increasing demand for building trades mechanics. Bridge workers and common laborers on subway construction in especially good demand.

Pittsburgh — Hod carriers striking for $1.12½ per hr. which will make an advance of 12½c. over the present rate.

St. Louis—Employment most active among skilled mechanics engaged in residential building work. Conditions in other industries favorable.

San Francisco — Slight scarcity of bricklayers, plasterers and carpenters; other trades plentiful but without unemployment to any appreciable degree.

Seattle—Lumber mills in Northwest closing down in advance of regular seasonal schedule. Call for men in construction and agriculture heavier than usual.

Monthly Prices of Construction Materials

Ups and Downs of the Market

THE general cost level is exactly the same as that of June 1. In the meantime there has been some slight fluctuation in prices of minor materials. Firmness is noted in railroad and paving materials, pipe, brick, cement and concrete aggregates, structurals, reinforcing bars, rope and roofing materials. There is some weakness in pig iron, lime, tile, tank plates, lower grades of lumber, scrap, rivets, glass, linseed oil and steel sheets.

Pig Iron—Demand running mostly to small tonnage lots; maximum quotations on No. 2 fdry., Southern has dropped $1 per ton during past two weeks; present price about $1 per ton below a year ago. Market trend though downward, is not strongly so and possibilities of advances are remote.

Railway Supplies—Light rails advanced $1 per ton in Pittsburgh and Chicago during the month; the market for this material has been steadily advancing during the past sixty days. Spikes and ties are firm; there is slight fluctuation in some of the other track supplies.

Pipe—Aside from some firmness in c.-i. pipe in the Chicago district the market showed few changes during the month; general level is about $10 per ton below a year ago. Sewer pipe, sizes 24-in. and under, developed slight weakness in the Detroit district; prices remained firm elsewhere. Clay drain tile, wrought iron and steel pipe displayed the usual resistance to price change noted in these materials during the past year.

Road and Paving Materials—Bulk asphalt is up $3 per ton in Kansas City; firmness noted elsewhere. Other advances in this class during the month were: 90c. per sq. yd. in granite paving blocks at Philadelphia; 15c. per sq. yd. on wood blocks at Kansas City, Mo. and 2½c. per. sq. yd. on the same material in Boston; the trend is also upward in New York. Road lettings, for June, were 20 per cent under the preceding month in money value; since materials were higher, this indicates a drop in volume.

Sand, Gravel and Crushed Stone—Of nineteen cities reporting to *E. N.-R.*, none showed price changes in sand and ¾-in. gravel during the month. Crushed stone (cobble) is considerably higher in Detroit.

Lime and Cement—The latter is firm throughout the entire country; mill stocks show seasonal decline. Lime prices are weaker in the Northeastern states, particularly in common lump lime. A rise of 10c. per bbl. is reported in Birmingnam on common lump.

Brick and Hollow Tile—Brick rose $1 per M. in New York and 50c. in San Francisco during the month. A drop of $1.50 per M., however, occurred in Detroit and a smaller decline in Minneapolis, at the same time. The firmness in New York is due mainly to strikes and heavy demand. Along the Atlantic Seaboard there have been some recent declines in tile; in other sections the price schedules are unaffected.

Structural Steel—The principal hot-rolled products are in good demand and average $2 per 100 lb. at Pittsburgh mills. Quotations as low as $1.80, however, are heard on shapes and plates and $2.10 per 100 lb. on reinforcing bars. Price weakness is confined to sheets and wire products in which there is considerable cutting under.

Lumber—Declines are in excess of advances and affect mostly boards and timbers. Dimension lumber is firmer particularly in the Philadelphia, Dallas and Detroit districts. Demand is most promising in better grades of pine flooring, finish, railroad material and special cutting. Pine mills are curtailing output of lower grades while fir mills in the Northwest are shutting down in advance of the regular seasonal closing time.

Iron and Steel Scrap — While the market is slow, some firmness is reported in Chicago on No. 1 railroad wrought and machine shop turnings.

Miscellaneous—Increasing firmness is noted in rope and roofing materials.

E. N.-R. Prices of Construction Materials

Price advances since last month are indicated by **heavy type**; declines by *italics*

PIG IRON—Per Gross Ton f.o.b.:

	July 2	One Year Ago
CINCINNATI		
No. 2 Southern (silicon 2.25@2.75)	**$23.05**	$25.05
Northern Basic	22.27	24.00
Southern Ohio No. 2 (silicon 1.75@2.25)	22.77	24.00
NEW YORK, tidewater delivery		
Southern No. 2 (silicon 2.25@2.75)	27.37	28.00
BIRMINGHAM		
No. 2 Foundry (silicon 2.25@2.75)	*19.00*@20.00	20.00@21.00
PHILADELPHIA		
Eastern Pa., No. 2X (2.25@2.75 sil.)	23.26	24.25
Virginia No. 2 (silicon 2.25@2.75)	29.17	28.17
Basic	22.26	24.00
Gray Forge	22.75	24.00
CHICAGO		
No. 2 Foundry Local (silicon 1.75@2.25)	22.00	24.50
No. 2 Foundry Southern (silicon 2.25@2.75)	15.55	27.00
PITTSBURGH, including freight charge ($1.76) from the Valley		
No. 2 Foundry Valley (silicon 1.75@2.25)	22.77	25.77
Basic	22.77	25.77
Bessemer	22.77	26.77

SCRAP—The prices following are f.o.b., per gross ton paid to dealers and producers:

	New York	Chicago	Birmingham
No. 1 railroad wrought	$14.00	**$14.50@$15.00***	$15.00@$16.00
Stove plate	11.00	14.00@14.50*	13.00@14.00
No. 1 machinery cast	14.00	17.50@18.00*	16.50@17.00
Machine shop turnings	9.00	**9.00@9.50**	7.00@8.00
Cast borings	10.00	10.50@11.00	15.00@16.00
Railroad malleable	13.00	*17.50@18.00*	*17.00@*18.00
Re-rolling rails	14.00	17.50@18.00	16.50@17.00
Re-laying rails	20.00	25.00@26.00	21.00@22.00
Heavy melting steel	12.00	15.50@16.00	13.00@14.00

*Per net ton.

Railway Supplies

STEEL RAILS—The following quotations are per ton f.o.b. for carload or larger lots. For less than carload lots 5c. per 100 lb. is charged extra:

	Pittsburgh				
	July 2	One Year Ago	Birmingham	Chicago	St. Louis
Standard bessemer rails	$43.00	$43.00	$43.00	$43.00	$46@49
Standard openhearth rails	43.00	43.00	43.00	43.00	48@52
Light rails, 8 to 10 lb.	**34@36**	38@40	34@35	**1.80@1.90**	
Light rails, 12 to 14 lb.	**34@36**	38@40	34@36	**1.80@1.90**	2.05@2.15*
Light rails, 25 to 45 lb.	34.00	38@40	34@36	**1.80@1.90**	1.95@2.10*
Re-rolled rails	.....	35@36	.....	.....	

*Per 100 lb.

RAILWAY TIES—For fair-sized orders, the following prices per tie hold:

	6 In. x 8 In. by 8½ Ft.	7 In. x 9 In. by 8½ Ft.
Chicago, White Oak	$1.50	$2.00
Chicago, (creosoted) (zinc treated)	1.85	2.10
San Francisco..... Green Douglas Fir	.84	1.14
San Francisco, Empty Cell Creosoted, Douglas Fir	1.70	2.25
St. Louis, White Oak, plain	1.15	1.35
St. Louis (creosoted) (zinc treated)	1.55	1.75
St. Louis, Red Oak, plain	1.05	1.25
St. Louis, Sap pine-cypress	1.00	1.20
Birmingham, White Oak	1.25	1.45

TRACK SUPPLIES—The following prices are base per 100 lb. f.o.b. Pittsburgh mill for carload lots, together with the warehouse prices at the places named:

	Pittsburgh				San Francisco	Birmingham
	July 2	One Year Ago	Chicago	St. Louis		
Standard spikes, ⅜-in. and larger	$2.80	$2.90@3.00	$3.55	$3.65	$4.35	$2.90
Track bolts	3.90@4.00	3.75@4.25	4.55	**4.65**	5.85	3.90
Standard section angle bars	*2.75*	2.75	3.30	3.40	4.00	3.85

Pipe

WROUGHT PIPE—The following discounts are to jobbers for carload lots at Pittsburgh mill:

BUTT WELD

Inches	Steel Black	Steel Galv.	Inches	Iron Black	Iron Galv.
1 to 3	62	50½	1 to 1¼	30	13

LAP WELD

2	55	43½	2	23	7
2½ to 6	59	47½	2½	26	11
7 and 8	56	43½	3 to 6	28	13
9 and 10	54	41½	7 to 12	26	11
11 and 12	53	40½			

BUTT WELD, EXTRA STRONG, PLAIN ENDS

1 to 1½	60	49½	1 to 1½	30	14
2 to 3	61	50½			

LAP WELD, EXTRA STRONG, PLAIN ENDS

2	53	42½	2	23	9
2½ to 4	57	46½	2½ to 4	29	15
4½ to 6	56	45½	4½ to 6	28	14
7 and 8	52	39½	7 and 8	21	7
9 and 10	45	32½	9 to 12	16	2
11 and 12	44	31½			

WROUGHT PIPE—From warehouses at the places named the following discounts hold for steel pipe:

	Black			
	New York	Chicago	Birmingham	St. Louis
1 to 3 in. butt welded	53%	59½%	62%	49%
3½ to 6 in. lap welded	48%	56½%	59%	46%

	Galvanized			
	New York	Chicago	Birmingham	St. Louis
1 to 3 in. butt welded	39%	48%	50½%	36%
3½ to 6 in. lap welded	35%	45%	47½%	33%

Malleable fittings, Classes B and C, banded, from New York stock sell at list plus 4%; class A, plus 23%. Cast iron, standard sizes, 36% off.

CAST-IRON PIPE—The following are prices per net ton for carload lots:

	Birmingham	Pittsburgh	New York	
			July 2	One Year Ago
4 in.	$45.00	$51.20@52.20	$55.60@56.60	$65.60@66.60
6 in. and over	40.00	47.20@48.20	50.60@51.60	60.60@61.60

	Chicago	St. Louis	San Francisco
4 in.	**$51.70@52.20**	$51.60	**$56.00**
6 in. and over	**47.70@48.20**	47.60	52.00

Gas pipe and Class "A," $4 per ton extra.

CLAY DRAIN TILE—The following prices are per 1,000 lin.ft.:

	New York					
Size, In.	July 2	One Year Ago	St. Louis	Birmingham	San Francisco	Dallas
3	$48.00	$45.00	$40.00	$45.00	.....	$73.00
4	50.00	55.00	40.00	56.00	$76.50	110.00
5	70.00	80.00	.....	80.00	97.75	118.00
6	92.00	105.00	70.00	100.00	127.50	150.00
8	160.00	170.00	170.00	165.00	212.50	210.00

SEWER PIPE—The following prices are in cents per foot for standard pipe in car load lots, f.o.b., except as otherwise stated:

Size, In.	New York Delivered	Pittsburgh	Birmingham	St. Louis	Chicago	San Francisco	Dallas
3	.....	$0.081	$0.10	.....	.....	$0.12	.....
4	.....	.081	.10	$0.10	.....	.15	$0.15
5	.....	.1215	.135	.....	.....	.18	.18
6	$0.21	.1215	.135	.14	.....	.21	.21
8	.35	.189	.21	.225	.....	.30	.325
10	.52	.2835	.315	.315	.....	.42	.476
12	.66	.3645	.45	.405†	.....	.56	.612
15	1.14†	.486	.54	.675†	.....	.92	1.02
18	1.65†	.675	.75	.945†	.....	1.32	1.53
20	1.98†	.81	.90	1.26†	.....	.....	.....
22	2.65†	1.08	1.20	.....	.....	.....	1.564
24	2.97†	1.215	1.35	1.62†	.....	2.16	2.04
27	4.65†	2.405	2.665	2.45†	.....	3.00	3.34
30	5.16†	2.664	2.952	3.00†	.....	3.60	4.06
33	6.98†	3.60	3.96	3.55†	.....	.....	4.99
36	8.00†	4.10	4.51	3.95†	.....	.....	5.42

	3	5	8	12	24	36
Boston	$0.13	$0.20	$0.32	$0.65	$2.05†	$5.60†
Minneapolis	.....	.....	.25	.45	1.50	4.76†
Denver	.135*	.18*	.27	.47	1.70	.....
Seattle	.14	.....	.35	.72†	2.60†	.....
Los Angeles	.1625	.195	.275	.495	1.65	.....
New Orleans	.115*	.177*	.295	.5615	1.907	.....
Cincinnati	.105	.1575	.245	.4725	1.575	4.715
Atlanta	.11*	.16½*	.27½	.4675	1.7875	.....
Montreal	.68‡	.45†	.70	1.35	4.50†	.....
Detroit	.07	*.1125*	*.175*	*.3375*	*1.935*†	5.6375†
Baltimore	.111	.166	.259	.499	1.665	4.92
Kansas City, Mo.	.15*	.21*	**.33½**	.52	.....	.....
Philadelphia	.12	.18	.28	.54	1.80	4.61

*4-in., 6-in., 9-in., respectively. †Double Strength. ‡3-in. special.

Road and Paving Materials

ROAD OILS—Following are prices per gallon in tank cars, 8,000 gal. minimum f.o.b. place named:

	July 2	One Year Ago
New York, 45% asphalt (at terminal)	$0.065 @$0.07	$0.053
New York, 65% asphalt (at terminal)	.0675@.0725	.051
New York, binder (at terminal)	.07 @.075	.06
New York, flux (at terminal)	.07 @.075	.04
New York, liquid asphalt (at terminal)	.07 @.075	.048
St. Louis, 40@50% asphalt	.049	.046
St. Louis, 50@60% asphalt	.0527	.048
Birmingham, 55% asphalt	.0475	
Dallas, 45% asphalt	.0495	.0495
Dallas, 55% asphalt	.0455	.0455
Dallas, binder	.061	.061
San Francisco, binder, per ton	13.50*	11.00*

* F.o.b. Oleum, Cal. Freight to San Francisco, 80c. per ton.

E. N.-R. Prices of Construction Materials

ASPHALT—Price per ton in packages (350-lb. bbls. or 425-lb. drums) and in bulk in carload lots, f.o.b. points listed:

	Package	Bulk
New York (*Mexican*)	$23.50*	$19.50
Boston (*Mexican*)	22.00	17.50
Chicago (*Trinidad*)	31.00	
San Francisco, *f.o.b. refinery*, Oleum, Cal.	19.50	13.50
Dallas (*Texas*)	27.10	21.10
Seattle, *"D" grade, California, f.o.b. Richmond*	19.50	13.50
Denver (*California*)	24.00	
Minneapolis, *f.o.b. Twin Cities* (*Stanolind*)	27.60	21.60
St. Louis (*Mexican*)	26.50	23.00
Baltimore (*Mexican*) (*f. o. b. refinery*)	22.50	18.50
Montreal (*Imperial*)	28.00	21.00
Atlanta (*Mexican*)	28.40	24.40
Detroit (*Mexican*)	22.00	18.00
Cincinnati (*Kentucky Rock*)		11.65
Maurer, N. J. (*Bermudez*)	30.00	28.00
Maurer, N. J. (*Mexican*)	24.00	22.00
Philadelphia (*Mexican*)	24.00	22.00
Kansas City (*Texas*)	27.30	**25.30**
Los Angeles (*"D" grade, California*)	19.50†	13.50†
Birmingham (*Mexican*)	27.00	21.00
New Orleans (*Mexican*)	20.00	17.00

*In drums. †f.o.b. El Segundo Refinery.

NOTE—Barrels or drums are optional in most cities. About 6 bbls. to the ton, and from 4 to 5 drums; 200 to 300 gal. to the ton.

PAVING STONE—

New York (grade I)	5-in. granite, 30 blocks per sq.yd.	$142.00 per M.
Chicago	About 4x8x4 dressed	per sq.yd.
	About 4x8x4 common	per sq.yd.
San Francisco	Basalt block 4x7x8	70.00 per M.
Boston	5-in. granite, 28 blocks per sq.yd.	130.00 per M.
Atlanta	Granite	2.50 per sq.yd.
Detroit	5-in. Granite	3.00 per sq.yd.
Baltimore	Granite	2.85 per sq.yd.
Montreal	Granite	104.75 per M.
New Orleans	Granite, 4x8x4	3.25 per sq.yd.
Cincinnati	Granite	135.00 per M.
St. Louis	4x8x4	1.65 per sq.yd.
Kansas City	Granite	4.00 per sq.yd.
Philadelphia	Granite	**3.90@4.25** per sq.yd.
Minneapolis	Sandstone	2.74 per sq.yd.

FLAGGING—

New York	Bronx, 4 ft. wide	$0.24 per sq.ft.
	Manhattan, 4 ft. wide	24 per sq ft.
	Queens, 5 ft. wide	26 per sq.ft.
	6x24-in. cross-walk	1.25 per lin.ft.
Chicago	18 in. wide	per lin.ft.

CURBING—*New York*: Bluestone per lin.ft., f.o.b. barge New York, 5x16 in., 88c.; *St. Louis*: Class "A" straight, delivered 5x18 in., $1.05 per lin.ft.; roundings, $1.60. *Birmingham:* Limestone, 5x18-in., $1.05 per lin. ft.

WOOD BLOCK PAVING—

	Size of Block	Treatment	Per Sq.Yd
New York	3	16	**$2.55**
New York	3½	16	**2.86**
Boston	3½	18	**2.55**
Chicago	4	16	2.25
Chicago	3½	16	2.10
St. Louis	3½	16	2.40
St. Louis	4	16	2.70
Seattle	4	16	Off market
Minneapolis	3½	16	2.49
Atlanta	3½	16	2.00
New Orleans	3	16	2.20
New Orleans	3½	16	2.30
New Orleans	4	16	2.40
Dallas	4	18	3.90
Baltimore	3½	16	None used
Montreal	4	16	4.50
Detroit	3	16	1.94
Detroit	4	16	
Cincinnati	3½	16	2.38
Kansas City	4	16	**4.15**
Philadelphia	4	16	None used

Construction Materials

SAND AND GRAVEL—Price for cargo or carload lots to contractor is as follows, per cu.yd.:

	Gravel 1½ In. July 2	Gravel 1½ In. One Year Ago	Gravel ¾ In. July 2	Gravel ¾ In. One Year Ago	Sand July 2	Sand One Year Ago
New York (*alongside dock*)	$1.75	$1.75	$1.75	$1.75	$1.00	$1.00
Denver	1.90	1.90	1.90	1.90	1.00	1.00
Chicago	2.75	2.00	2.75	2.00	2.75	2.00
St. Louis	1.45	1.45	1.45	1.45†	1.18	1.18†
Seattle	1.50	1.50	1.50	1.50	1.50	1.50
Dallas	2.25	2.38	2.38	2.38	2.00	2.00
Minneapolis	1.65*	1.85*	1.65*	1.85*	1.25	1.25
Cincinnati	1.40†	1.40	1.40†	1.40†	1.35†	1.35†
San Francisco	2.15	2.15	2.15	2.15	1.50	1.50
Boston	1.50†	1.40†	1.50†	1.40†	1.00†	1.00†
New Orleans	2.60	3.00	2.60	3.00	1.75	1.25
Los Angeles	1.30†	2.15	1.30	2.20	1.10†	1.70
Atlanta	1.90†	2.00†	1.90†	2.00†	1.40†	1.40†
Detroit	2.02	2.60	2.02	1.75	1.62	1.35
Baltimore	1.40	1.40	1.60	1.60	0.70*†	0.70*†
Montreal	1.25†	1.25†	1.25†	1.50†	1.25†	1.25†
Birmingham	2.00		2.00		1.45	1.25†
Philadelphia	2.10	2.10	2.10	2.10	1.50	1.50
Kansas City (Joplin chats)	4.00		4.00		0.66*†	0.66*†

New York—Grits, $1.75 per cu. yd.; ready mixed, **$1.85**.
Los Angeles—Freight from quarry, 70c. per ton, and is included in above price.
*At pit. † Per ton.

CRUSHED STONE—Price for cargo or carload lots, f.o.b. city, is as follows per cu.yd.:

	1½ In. July 2	1½ In. One Year Ago	¾ In. July 2	¾ In. One Year Ago
New York	$1.75	$1.75	$1.85	$1.85
Chicago	2.75	2.00	2.75	2.00
St. Louis	1.83*	1.80*	1.83*	1.75*
Dallas	2.40	2.83	2.83	2.83
San Francisco	2.15	2.15	2.15	2.15
Boston	1.60*	1.45*	1.60*	1.45*
Minneapolis	1.75	1.75	1.75	1.75
Kansas City	1.50	1.50	1.50	1.50
Denver	2.50	3.50	2.50	3.50
Seattle	3.00	3.00	3.00	3.00
Atlanta	2.00*	2.00*	2.00*	2.00*
Cincinnati	1.90*	1.90*	1.90*	1.90*
Los Angeles	1.50*		1.50*	
Detroit	**1.90***	1.70	**1.90***	1.70
Baltimore	2.50	2.50	2.55	2.55
Montreal	1.80*	1.80*	1.90*	1.90*
Philadelphia	2.10	2.10	2.10	2.10
Pittsburgh	2.85	2.85	2.85	2.85
Cleveland	3.25*	3.25*	3.25*	3.25*
Birmingham	2.00		2.00	

*Per ton.

CRUSHED SLAG—Price of crushed slag in carload lots, per net ton, at plants

	1½-In.	¾-In.	Roofing	Sand
Youngstown District	$1.25	$1.35	$2.00	$1.25
Steubenville District	1.25	1.30	2.00	1.30
Ironton District	1.40	1.40	2.00	1.40
Easton, Catasauqua, Pa.			2.50	
Birmingham, Ala.	.80@.90	1.15	2.05	
Buffalo, N. Y., and Erie, Pa.	1.25	1.25	2.25	1.25
Cleveland, Ohio	1.30	1.30	1.30	1.30
Eastern Pa. and Northern N. J.	1.25	1.25	2.50	1.25
Western Pennsylvania	1.25	1.25	2.50	1.25
Longdale and Glen Wilton, Va.	1.25	1.25	2.50	
Toledo, Ohio	1.25	1.25	1.50	1.25

LIME—Warehouse prices:

	Hydrated, per Ton— Finishing	Hydrated, per Ton— Common	Lump, per Barrel— Finishing	Lump, per Barrel— Common
New York	$18.20	$12.00@$13.10	$3.50*	*$2.25*@2.75*
Chicago	20.00	18.00		1.21†
St. Louis	23.00	19.00	12.50‡	12.50‡
Boston	20.00	*13.50*@15.00	3.75*	3.00*
Dallas	20.00			1.85†
Cincinnati	16.80	14.30		13.40‡
San Francisco		22.00		1.60†
Minneapolis	25.50	21.00 (white)	1.60@1.70†	1.35†
Denver	24.00			2.70†
Detroit	*12.40*	*12.40*		*17.00‡*
Seattle, *paper sacks*	24.00		2.80†	
Los Angeles		18.00		2.70†
Baltimore	24.25	17.85	2.55†	
Montreal		21.00		10.50‡
Atlanta	22.50	14.00	2.10†	1.45†
New Orleans	24.00	16.00	2.00†	2.00†
Philadelphia	23.00	16.00		1.21†
Kansas City	19.50	18.50	2.45*	2.10*
Birmingham	22.50	15.00	2.10†	**1.85†**

*Per 280-lb. bbl. (net). †Per 180-lb. bbl. (net). ‡Per ton.

NATURAL CEMENT—Price to dealers per bbl. for 500 bbl. or over, exclusive of bags:

	July 2	One Year Ago
Minneapolis (Rosendale)	$2.80	2.80
Kansas City (Ft. Scott)	1.35	1.80
Cincinnati (Utica)	1.72	1.72
Boston (Rosendale)	2.50	2.50
St. Louis (Carney)	2.30	2.45
Birmingham (Magnolia) pozzolan cement	2.40	2.10

PORTLAND CEMENT—Prices to contractors per bbl. in carload lots f.o.b points listed *without bags*. Cash discount not deducted.

	July 2	One Month Ago	One Year Ago
New York, del. by truck	$2.50@2.60	$2.50@2.60	$2.50@2.60
New York, alongside dock to dealers	2.15	2.15	2.15
Jersey City	2.33	2.33	2.33
Boston	2.50	2.50	2.63
Chicago	2.20	2.20	2.20
Pittsburgh	2.19	2.19	2.19
Cleveland	2.39	2.39	2.39
Detroit	2.35	2.35	2.40
Indianapolis	2.41	2.41	2.41
Milwaukee	2.35	2.35	2.35
Duluth	2.19	2.19	2.19
Peoria	2.37	2.37	2.37
Cedar Rapids	2.44	2.44	2.44
Davenport	2.39	2.39	2.39
St. Louis	2.30	2.30	2.30
San Francisco	2.31	2.31	2.61
New Orleans	2.40	2.40	2.40
Minneapolis	2.42	2.42	2.42
Denver	2.84	2.84	2.84
Seattle	2.65	2.65	2.90
Dallas	2.05	2.05	2.05
Atlanta	2.40	2.40	2.35
Cincinnati	2.47	2.47	2.47
Los Angeles	2.52	2.52	3.00
Baltimore	2.50	2.50	2.50
Birmingham	2.40	2.40	2.65
Kansas City, Mo.	2.20	2.20	2.27
Montreal	1.80	1.80	1.90
Philadelphia	2.41	2.41	2.41
St. Paul	2.42	2.42	2.42
Toledo	2.40	2.40	2.45

NOTE—Bags 10c. each, 40c. per bbl.; 20c. each in Canada, 80c. per bbl.

Current mill-prices per barrel in carload lots, without bags, to contractors:

Buffington, Ind.	$1.95	Hudson, N. Y.	$2.05
Universal, Pa.	1.95	Leeds, Ala.	1.95
Steelton, Minn.	2.00	Hannibal, Mo.	2.05
Fordwick, Va.	2.05	Lehigh Valley District	1.95
Mitchell, Ind.	2.05	Wyandotte, Mich.	2.10
Iola, Kan.	1.95	Alpena, Mich.	1.95
Mason City, Ia.	2.00	Richard City, Tenn.	2.05
La Salle, Ill.	2.05	Kingsport, Tenn.	2.05

E. N.-R. Prices of Construction Materials

TRIANGLE MESH—Price per 100 sq.ft. in carload lots:

PLAIN 4-INCH BY 4-INCH MESH

Style Number	Weight in Pounds per 100 sq.ft.	Pittsburgh Mill	Birmingham Mill	Warehouse: New York	St. Louis	Dallas	San Francisco
032	22	$0.97	$0.95	$1.39	$1.06	$1.13	$1.22
049	28	1.23	1.20	1.76	1.35	1.38	1.55
068	35	1.51	1.50	2.16	1.66	1.67	1.91
093	45	1.94	1.93	2.77	2.13	2.00	2.46
126	57	2.59	2.38	3.45	2.63	2.55	3.03
153	68	2.86	2.85	4.11	3.14	3.15	....
180	78	3.28	3.28	5.70	3.60	3.47	....
245	103	4.33	4.33	6.21	4.75	4.58	....
287	119	5.00	5.00	7.19	5.50	5.26	6.35
336	138	5.80	5.80	8.35	6.37	6.11	....
395	160	6.72	6.72	9.65	7.38	7.12	....
		PAVING					
036P	17	$0.74	$0.75	$1.06	$0.81	$0.76	....
053P	24	1.04	1.05	1.50	1.14	1.07	....
072P	31	1.32	1.32	1.90	1.45	1.39	....
097P	40	1.70	1.70	2.45	1.87	1.90	....
049R	24	1.04	1.04	....	1.14	1.07	....
067R	31	1.32	1.30	....	1.45	1.39	....
089R	40	1.70	1.70	....	1.87	1.90	....

In rolls, 48-, 52-, and 56-in. wide and in 150-, 200- and 300-ft. lengths. Galvanized is about 15% higher. Size of roll carried in New York warehouses, 48 in. wide x 150 ft. long, or 600 sq.ft.

EXPANDED METAL LATH—Prices in carload lots per 100 yd. for painted:

Weight in pounds	New York	Birmingham	St. Louis	San Francisco	Dallas
2.2	$19.00	$22.00	$21.00	$24.00	$23.50
2.5	20.50	23.00	23.00	26.00	25.00
3.0	23.50	26.00	27.00	30.00	28.50
3.4	25.00	28.00	29.00	33.00	31.00

BARS, CONCRETE REINFORCING—Current quotations per 100 lb.:

ROLLED FROM BILLETS

Inches	Pittsburgh Mill	Warehouse, Uncut: Birmingham	New York	Chicago	St. Louis	Dallas	San Francisco
½ and larger	$2.00	$2.25	$3.24	$3.00	$3.15	$3.38	$3.35
⅝	2.10	2.35	3.34	3.10	3.25	3.43	3.45
¾	2.20	2.45	3.44	3.20	3.35	3.48	3.55
⅞	2.40	2.65	3.64	3.40	3.55	3.63	3.75
1	3.00	3.25	4.24	4.00	4.15	3.78	4.35

For size and cutting extras, see bar card of July 15, 1923.

ROLLED FROM RAILS

	St. Louis	Dallas		St. Louis	Dallas
½ and larger	$2.55*	*$2.80*	¾	$2.95*	*$3.05*
⅝ in.	2.65*	*2.85*	⅞	3.55*	*3.65*
¾	2.75*	*2.90*			

* Warehouse shipments.

BRICK—Contractors price per 1,000 in cargo or carload lots is as follows:

	Common: July 2	One Month Ago	One Year Ago	Paving: 3-inch*	Block: 4-inch*
New York (del.)	$19@20	$18@19	$23.65	$45.00	$51.00
New York (at dock)	16@17	15@16	20.00	....	....
Chicago	12.00	12.00	11.00	48.00	....
St. Louis, salmon (del.)	16.00	16.00	16@18	37.50	40.00
Denver, salmon	12.00	12.00	12.00	....	....
Dallas	12.10	12.10	14.10	35.00	....
San Francisco	15.50	15.00	15.50	....	....
Los Angeles	12.00	12.00	14.50	(not used)	
Boston (del.)	17.50	17.50	21.50	45.00	50.00
Minneapolis (del.)	13.50	13.50@13.60	13.00	....	....
Kansas City	14.50	14.50	16.50	(no market)	
Seattle	15.00	15.00	15.00	....	42.50
Cincinnati	17.00	17.00	17.00	40.00	45.00
Montreal	17.50	17.50	17.50	100.00†	68.00
Detroit (del.)	*16.00*	17.50	17.50	37.50	40.50
Baltimore	18.00	18.00	18.00	40.00	45.00
Atlanta	10.50	10.50	11.00	40.00	....
New Orleans	15.00	15.00	19.50	....	....
Birmingham	12.50	12.50	12.50	40.00	45.00
Philadelphia	19.00	19.00	19.00	40.00	50.00
Pittsburgh (del.)	16.00	16.00	16.00	....	....
Cleveland	14.00	14.00	16.00	....	....

*For paving blocks 3½x8½x3 and 3½x8½x4 respectively. †Imported.

HOLLOW TILE—Price per block in carload lots to contractor for hollow building tile.

	New York: July 2 on Trucks*†	One Year Ago	Chicago	Philadelphia	St. Louis	San Francisco†	Perth Amboy N. J., Factory*
4x12x12	$0.1162	$0.1162	$0.06	*$0.12*	$0.078	$0.108	....
6x12x12	.1743	.1743	.0825	....	.102	.156	....
8x12x12	.2179	.2179	.1125	*.22*	.14	.244	....
10x12x12	....	....	.14	....	.17	....	$0.252
12x12x12	....	....	.18	....	.198	....	.312

*5 per cent off for cash. Partition tile.

	8x12x12	12x12x12
Boston	$0.09	*$0.175*
Minneapolis (f.o.b. cars)	.0636	.106
Minneapolis (delivered)	.07	.116
Cincinnati	.07485	.13745
Kansas City	.085	.145
Denver	.085	.155
Seattle (delivered)	.10	.20
Los Angeles	.085	.172
New Orleans	.13	.30
Detroit (delivered)	.0775	.1743
Montreal	.12	.225
Baltimore	.125	.27
Atlanta	.0888	.1666
Dallas	.10	.19
Birmingham	.11	.1824
Pittsburgh (delivered)	.068	.128
Cleveland	.07	.13

STRUCTURAL MATERIAL—Following are base prices f.o.b. mill, Pittsburgh and Birmingham, together with quotations per 100 lb. from warehouses at place named:

	Pittsburgh Mill	Birmingham	Warehouse: New York	Dallas	St. Louis	Chicago	San Francisco
Beams, 3 to 15 in.	$2.00	$2.05	$3.34	$4.15	$3.25	$3.10	$3.30
Channels, 3 to 15 in.	2.00	2.10	3.34	4.15	3.25	3.10	3.30
Angles, 3 to 16 in., ¼ in. thick	2.00	2.10	3.34	4.15	3.25	3.10	3.30
Tees, 3 in. and larger	2.00	2.10	3.34	4.15	3.35	3.10	3.30
Plates, ¼ in. thick and heavier	1.90	2.00	3.34	4.15	3.25	3.10	3.30

RIVETS—The following quotations are per 100 lb.:

STRUCTURAL

	Pittsburgh Mill	Warehouse: New York July 2	New York One Yr. Ago	Chicago	St. Louis	San Francisco	Dallas
½ in.	$2.40@*$2.50*	$4.50	$4.00	$3.50	$3.65	$5.00	$4.75
	CONE HEAD BOILER						
½ in.	$2.90	$4.70	$4.20	$3.70	$4.20	$5.20	$5.00
⅝ and ¾	3.05	4.85	4.36	3.80	4.45	5.35	5.15
¾ and ⅞	3.30	5.10	4.60	4.05	4.60	5.60	5.50

NAILS—The following quotations are per keg from warehouse:

	Pittsburgh Mill	Birmingham	Chicago	San Francisco	Dallas	St. Louis	Montreal
Wire	$2.75	$2.85	*$3.15*	$3.85	$4.50	$3.33	4.95
Cut	2.90	2.90	....	5.25	5.00	3.58	5.00

SHIP SPIKES—Current prices per 100 lb.:

In.	San Francisco: Galv.	Black	Seattle Black
½	$8.00	$6.00	$7.75
⅝	7.30	5.30	5.65
¾	7.15	5.15	5.50

Pittsburgh base in lots of 200 kegs or more, $3.25.

PREPARED ROOFINGS—Slate-surfaced roofing (red and green) in rolls of 108 sq.ft. costs $2.75 per roll to consumers in less than carload lots f.o.b. Philadelphia.

Single shingles, red and green slate finish, cost $7.56 per square (sufficient to cover 100 sq.ft.) in less than carload lots, f.o.b. Philadelphia. Strip shingles (4 in 1) f.o.b. Philadelphia, l.c.l., $5.80 per square.

ROOFING MATERIALS—Prices f.o.b. New York, to consumers in less than carload lots:

Tar felt (14 lb. per square of 100 sq.ft.) per ton	$84.38
Tar pitch (in 400-lb. bbl.), per 100 lb.	1.86
Asphalt roofing (in barrels), per ton, f.o.b. plant	38.81
Asphalt felt (light), per ton, f.o.b. plant	87.75
Asphalt felt (heavy), per ton, f.o.b. plant	87.75

Delivered in Metropolitan Dist., $2.00 additional.

WINDOW GLASS—United inches, 25, bracket size 6x8 to 10x15, single thickness "AA," 82 per cent; "A," *87* per cent; "B," 88 per cent. Double thickness "AA," 82 per cent; "A," *88* per cent; "B," *89* per cent discount from jobbers list at New York warehouses.

SHEETS—Quotations are per 100 lb. in various cities from warehouse also the base quotations from mill:

Blue Annealed	Pittsburgh Large Mill Lots	St. Louis	Chicago	San Francisco	New York
No. 10	*$2.25@2.30*	$3.90	*$3.50*	*$3.70*	$3.89
No. 12	*2.30@2.35*	3.95	*3.55*	*3.75*	3.94
No. 14	*2.35@2.40*	4.00	*3.65*	*3.80*	3.99
No. 16	*2.45@2.50*	4.10	*3.85*	*3.90*	4.09
Black					
*Nos. 17 to 21	*2.90@3.00*	4.60	*3.80*	*4.45*	*4.15*
*Nos. 22 to 24	*2.95@3.05*	4.65	*3.85*	*4.50*	*4.20*
*No. 26	*3.00@3.10*	4.70	*3.90*	*4.55*	*4.25*
*No. 28	*3.10@3.20*	4.80	*4.00*	*4.65*	*4.35*
Galvanized					
No. 10 and 11	*3.15@3.25*	4.80	*4.00*	*4.75*	*4.35*
No. 12 to 14	*3.25@3.35*	4.90	*4.10*	*4.85*	*4.45*
No. 16	*3.40@3.50*	....	*5.00*	*5.00*	*4.60*
Nos. 17 to 21	*3.55@3.65*	5.20	*4.40*	*5.15*	*4.75*
Nos. 22 to 24	*3.70@3.80*	5.35	*4.55*	*5.30*	*4.90*
*Nos. 25 and 26	*3.85@3.95*	5.50	*4.70*	*5.45*	*5.05*
*No. 28	*4.15@4.25*	5.80	*5.00*	*5.75*	*5.35*

* For painted corrugated sheets add 30c. per 1,000 lb. for 5 to 28 gage; 25c. for 19 to 24 gages; for galvanized corrugated sheets add 15c., all gages.

LINSEED OIL—These prices are per gallon:

	New York: July 2	New York: One Year Ago	Chicago: July 2	Chicago: One Year Ago
Raw in barrels (5 bbl. lots)	*$1.07*	$1.00	$1.23	$0.94

E. N.-R. Prices of Construction Materials

WHITE AND RED LEAD—Per 100-lb. keg, base price, f.o.b. New York:

	Dry		In Oil	
	July 2	1 Yr. Ago	July 2	1 Yr. Ago
Red	$15.75	$15.00	$17.25	$16.50
White	15.75	15.00	15.75	15.00

Lumber

Prices wholesale, per M. ft. b.m., to dealers in carload lots, f.o.b.

San Francisco—Prices of rough Douglas fir No. 1 common, in carload lots to dealers at yards. To contractors, $2 per M. ft. additional.

	6-8 and 12 Ft.	10-16-18 and 20 Ft.	22 and 24 Ft.	25 to 32 Ft.
3x3 and 4	$26.00	$27.00	$28.00	$31.00
3x6 and 8	26.00	27.00	28.00	31.00
4x4-6 and 8	26.00	27.00	28.00	31.00
3x10 and 12	26.00	27.00	28.00	31.00
3x14	30.00	30.00	32.00	34.00
4x10 and 12	26.00	27.00	28.00	31.00
4x14	30.00	30.00	32.00	34.00
	24 Ft. and Under		25 to 32 Ft.	33 to 40 Ft.
6x10	$28.00		$30.00	$32.00
6x14	34.00		36.00	38.00
8x10	28.00		30.00	32.00
8x14	34.00		36.00	38.00

New York and St. Louis—Wholesale prices to dealers of long leaf yellow pine.

	New York*		St. Louis	
	20 Ft. and Under	22-24 Ft.	20 Ft. and Under	22-24 Ft.
3x4 to 8x8	$45.00	$46.00	$39.00	$41.00
3x10 to 10x10	49.00	50.00	43.00	45.00
3x12 to 12x12	54.00	55.00	48.00	50.00
3x14 to 14x14	62.00	63.00	55.00	57.00
3x16 to 16x16	70.00	71.00	62.00	64.00
3x18 to 18x18	.....	.....	67.00	69.00
4x20 to 20x20	.....	.....	77.00	79.00

* Wholesale price to dealers; to contractors, delivered from lighters or cars to job, $5 additional. Short leaf pine costs $3 per M. less.

Over 24 ft.—Add $1 for each additional 2 ft. in length up to 30 ft. for sizes 12x12 and under; for sizes over 12x12 add $2; for merchantable add $2 to sizes 10x10 and under.

Other Cities	8x8-In. x 20 Ft. and Under				12x12-In. 20 Ft. and Under	
	P.	Fir*	Hemlock	Spruce	P.	Fir*
Boston	$50.00	$48.00†	$50.00	$50.00	$60.00	$58.00†
Seattle	.....	29.50	.....	.....	.....	23.00
New Orleans	42.00	.....	.....	.....	32.00	.....
Baltimore	32.50	49.25	53.00	60.00	38.00	49.75
Cincinnati	37.00	73.00	73.00	85.00	48.00	77.00
Montreal	50.00	58.00	.....	.....	60.00	65.00
Los Angeles	.....	37.00	.....	.....	.....	38.00
Denver	.....	35.75	35.75	35.75	.....	36.25
Minneapolis	43.00	38.75	35.00	.....	44.50	38.75
Atlanta	31.00	.....	.....	.....	34.00	.....
Dallas	52.00	.....	.....	.....	56.00	.....
Kansas City	41.00	40.75	.....	.....	52.00	41.75
Birmingham	32.00	.....	.....	.....	34.00	.....
Philadelphia	54.00	34.00	37.00	40.00	62.00	34.00
Detroit	44.75	49.75	.....	.....	53.75	49.75
St. Louis	39.00	.....	.....	.....	48.00	.....

	1-In. Rough, 10 In. x 16 Ft. and Under			2-In. T. and Gr. 10 In. x 16 Ft.	
	P.	Fir*	Hemlock	P.	Fir*
Boston	$45.00	$42.00†	$44.00	$50.00	$48.00†
Seattle	.....	25.00	.....	.....	29.00
New Orleans	80.00	.....	.....	40.00	.....
Baltimore	55.00	44.00	44.00	34.00	50.00
Cincinnati	70.00	79.00	75.00	38.00	85.00
Montreal	56.00	50.00	45.00	45.00	45.00
Los Angeles	.....	32.00	.....	.....	95.00
Denver	.....	30.25	30.25	.....	32.75
Minneapolis	43.00	37.75	34.75	38.00	35.25
Atlanta	18.00	.....	.....	28.00	.....
Dallas	52.00	.....	.....	56.00	.....
Kansas City	49.25	42.25	.....	39.75	48.75
Birmingham	.....	.....	.....	.....	.....
Philadelphia	32.00	33.00	36.00	54.00	34.00
Detroit	36.75	39.50	.....	44.00	41.25
St. Louis	43.00	.....	.....	29.00	.....

Birmingham—Quotes carload lots, f.o.b. sidings; $4.00 additional per M. ft. to contractors.
Boston and Cincinnati—Prices to contractors in carload lots, f.o.b.
Denver—Quotes dealers price to contractors on large projects.
St. Louis—Wholesale price to contractors, f.o.b. cars, $2 per M.ft. additional.
Seattle—Price to contractors, delivered.
Dallas—Wholesale to contractors, $10 per M.ft. additional.
*Douglas fir. †Prime.

PILES—Prices per lineal foot, pine piles with bark on, f.o.b. New York.

Diameters	Points	Length	Barge	Rail
12 in. at butt	6 in.	30 to 50 ft.	$0.14½	$0.18½
12 in.—2 ft. from butt	6 in.	50 to 59 ft.	.19	.23½
12 in.—2 ft. from butt	6 in.	60 to 69 ft.	.21½	.25½
14 in.—2 ft. from butt	6 in.	50 to 69 ft.	.25½	.34
14 in.—2 ft. from butt	6 in.	70 to 79 ft.	.27½	.36½
14 in.—2 ft. from butt	5 in.	80 to 89 ft.	.35	.41

Miscellaneous

STEEL SHEETPILING—The following price is base per 100 lb. f.o.b. Pittsburgh, with a comparison of a month and a year ago:

July 2	One Month Ago	One Year Ago
$2.25@2.30	$2.25@2.30	$2.30@2.40

WIRE ROPE—Discounts from list price on regular grades of bright and galvanized are as follows:

	Eastern Territory New York and East of Missouri River
Plow steel round strand rope	35%
Special steel round strand rope	30%
Cast steel round strand rope	20%
Round strand iron and iron tiller	5%
Galvanized steel rigging and guy rope	7½%
Galvanized iron rigging and guy rope	+12½%

California, Oregon, Nevada and Washington: Discount 5 points less than discount for Eastern territory.
Wyoming, New Mexico and Colorado: Discount 5 points less than discount for Eastern territory.
Arizona: Discount 10 points less than discount for Eastern territory.
Montana, Idaho and Utah: Discount 10 points less than discount for Eastern territory.
North Dakota, Nebraska, Kansas, Oklahoma and Texas: Discount 5 points less than discount for Eastern territory.

MANILA ROPE—For rope smaller than ¾-in. the price is ½ to 2c. extra; while for quantities amounting to less than 600 ft., there is an extra charge of 1c. The number of feet per pound for the various sizes is as follows: ⅜-in., 8 ft.; ½-in., 6; ⅝-in., 4½; ¾-in., 3½; ⅞-in., 2 ft. 10 in.; 1-in., 2 ft. 4 in. Following is price per pound for ½-in. and larger, in 1200-ft. coils:

Boston	$0.19@.22	New Orleans	$0.26½
New York	.27	Los Angeles	.24½
Chicago	.21½	Seattle	.17
Minneapolis	.28½	St. Louis	.26½
San Francisco	.26	Montreal	.16
Atlanta	.28	Detroit	.19
Denver	.30	Baltimore	.18
Cincinnati	.21	Kansas City	.21½
Dallas	.31	Birmingham	.23@.25
Philadelphia	.26		

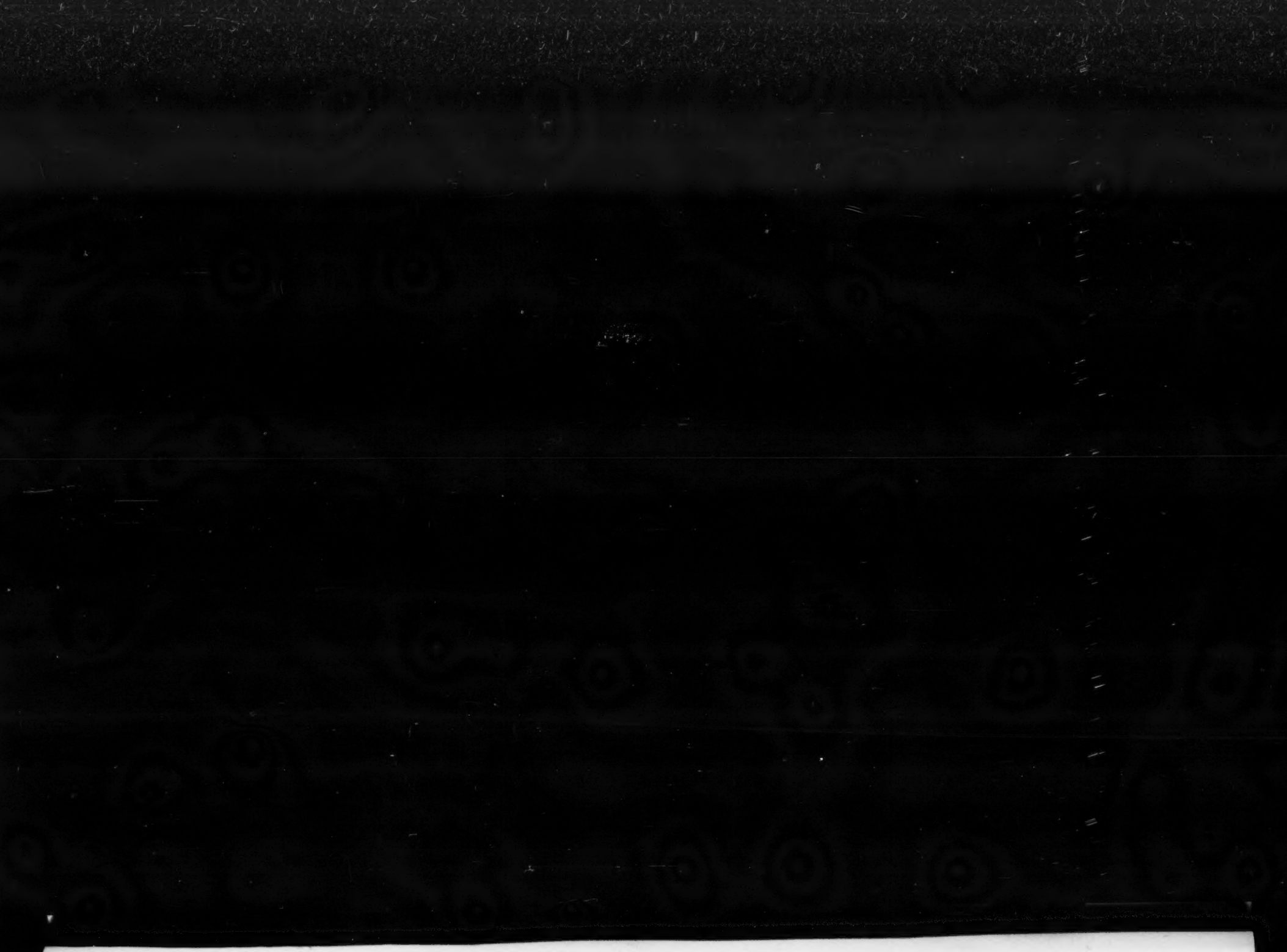
EXPLOSIVES—Price per pound of dynamite in small lots:

	Gelatin 40%	Gelatin 60%
New York	$0.27	$0.295
Boston	.225	.25
Kansas City	.2025	.2225
Seattle	.165	.19
Chicago	.1525	.1775
Minneapolis	.1917	.2123
St. Louis	.22	.245
Denver	.2025	.2275
Dallas	.225	.302
Los Angeles	.1875	.2125
Atlanta	.23	.255
Baltimore	.22	.23
Cincinnati	.22	.245
Montreal	.195	.235
Birmingham	.23	.235
New Orleans	.233	.26
San Francisco	.1625	1925
Philadelphia	.215	.24

CHEMICALS—Water and sewage treatment chemicals, spot shipments in carload lots, f.o.b. works:

Sulphate of aluminum, in bags, per 100 lb	$1.40@1.45
Sulphate of copper, in bbl., per 100 lb	4.50@4.60
Soda ash, 58%, in bags, per 100 lb	1.25
Chlorine, liquid, tanks, per lb	.04
Hypochlorite of lime (bleaching powder) in drums, per 100 lb	1.90@2.00

FREIGHT RATES—On finished steel products in the Pittsburgh district, including plates, structural shapes, merchant steel, bars, pipe fittings, plain and galvanized wire nails, rivets, spikes, bolts, flat sheets (except planished), chains, etc., the following freight rates are effective in cents per 100 lb., in carloads of 36,000 lb.:

Baltimore	$0.31	Detroit	$0.29
Birmingham	.58	Kansas City	.735
Boston	.365	New Orleans	.67
Buffalo	.265	New York	.34
Chicago	.34	Pacific Coast (all rail)	1.15*
Cincinnati	.29	Philadelphia	.32
Cleveland	.19	St. Louis	43
Denver	1.15*	St. Paul	.60

* Minimum carload, 50,000 lb., structural steel only; 80,000 lb., for other iron or steel products.